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ERRATA.

No. 1, VOLUME XXIV.

- Page 186, in column "length" line 8, for 7' 11" read 7' 1".
 „ „ in column "Remarks" for "511 lbs." read "565 lbs."

No. 1, VOLUME XXV.

Page 80, line 22, for *Engenii* read *Eugenii*.

No. 2, VOLUME XXV.

- Page 233, line 18, for "Type C" substitute Type B.
 „ 236 „ in the middle of the page under Type "B"
 should be "C" and "C" should be "B"
 „ 237, lines 21 and 22, under Type, substitute "C"
 for "B" and "B" for "C."

No. 3, VOLUME XXV.

- Page 475, line 25, for "a fine onmusth (tuskless male)" read
 "a Hine (= tuskless male) on musth."
 „ 493 „ 18, for "Home-like" read "Hun-like."
 „ 494 „ 8, from the bottom, for "big level" read
 "High-level."
 „ 508 „ 14, delete "them."
 „ 508 „ 6, from the bottom, for "dupped" read
 "dropped."
 „ 513 „ 14, from top, for negative read *végetative*.
 „ 513 „ 20, from top, for 1914 read 1917.

No. 4, VOLUME XXV.

- Page 669, 5 lines from bottom of page, for *Certhia himalayana*
 read *Certhia himalayana*.
 „ 767, line 19, for *Eublepharus* read *Eublepharis*.

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Tambe, Dr. Gopal Ramchandra (M.A., B.Sc., L.M. & S.)	Narsinghpur.
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Tasker, T. J. (I.C.S.)	Anantapur.
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Taylor, J. R.	Topchanchi.
Taylor, Dr. W. R. (M.R.C.S., L.R.C.S.)	Insein.
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Saheb Bahadur	Ajmer.
Tejpal, Goverdhandas Goculdas (<i>Life Member</i>)	Andheri.
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Tew, G. C. (I.C.S.)	Pyinmana.
Thatcher, E. C.	Dehra Dun.
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Thomas, E. F. (I.C.S.)	Madras.
Thomason College, The Principal	Roorkee.
Thompson, Miss A.	Europe.
Thomson, Major D. B.	Europe.
Thomson, H.	Poona.
Thomson-Glover, Capt. J. W.	Mesopotamia.
Thornhill, Capt. C. M. (D.S.O.)	Quetta.
Thornhill, Lt.-Col. Sir H. B. (K.C.I.B.)	Europe.

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Thruston, L. A. Europe.
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Tottenham, W. F. L. (I.F.S.) Shillong.
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Truitt, L. (I.C.S.) Calcutta.
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Turner, H. G. Europe.
Turner, Sir Montague Europe.
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Tweddie, Lt.-Col. J. L. Cairo.
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Tyng, G. A. V. Europe.
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Tyng, Col. H. C. Bushire.
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Underwood, Rev. J. E. Salin, Burma.

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United Service Club, The Secretary	Bangalore.
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Urwin, Lt.-Col. J. J. (I.M.S.)	Europe.
U. S. Department of Agriculture, The Librarian	Washington D. C.
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Walker, J. S. E.	Motihari, Bengal.
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Walker, Lt.-Col. F. Spring (I.A.)	Jhansi.
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Walsh, C. L.	Europe.
Walsh, E. P. (I.C.S.)	Rajahmundry.
Walsh, M. P.	Akola, Berar.
Walters, O. H.	Baruar.
Watson, Lt.-Col. H. J. (I.M.S., C.M.Z.S.)	Bombay.
Wapshare, J. H.	Nilgiris.

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Warburton, Major H. G. Mesopotamia.
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Ward, F. Kingdon... Mesopotamia.
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Wright, A. J.	Travancore.
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Wright, J. M. (I.C.S.)	Falsan, Chin Hills.

Wright, Major R. E. (I.M.S.) Bombay.
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Wroughton, R. C. (F.Z.S.) (<i>Life Member</i>) Europe.
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Yeolekar, T. G. (M.A., B.Sc.)	Bombay.
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Young, Lt.-Col. H. G. (D.S.O.)	Lahore Cantt.
Young, J. V. (I.F.S.)	Rangoon.
Young, L. W. H.	Bombay.
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Young, W. H. H. Lahore.
Yule, Major R. A.	Peshawar.
Zollinger, A. E. Amraoti, Berar.
Zumbro. Rev. W. M Madura.

BOMBAY NATURAL HISTORY SOCIETY

STATEMENT OF ACCOUNTS from 1st January to 31st December 1917

RECEIPTS.	Rs. a. p.	Rs. a. p.	PAYMENTS.	Rs. a. p.	Rs. a. p.
TO BALANCE OF 1ST JANUARY 1917—					
Cash with the National Bank of India, Ltd...	618 14 7		By Journal Account	9,090 8 10	
Fixed Deposit with the Mercantile Bank, Ltd.	5,000 0 0		" Salaries	7,340 15 1	
Balances as per Postage Book	32 14 8		" General Charges	798 14 8	
" " Petty Cash Book	49 15 11		" Rent	2,640 0 0	
			" Printing and Stationery (including Snake Book)	1,307 6 6	
TO Subscription for 1914 (in arrears) ..	80 0 0	5,701 18 0	" Amount paid to Col. Wall being a profit on copies of Snake Books sold	1,359 8 0	
" " 1915	260 0 0		" Petty Cash Expenses	424 2 9	
" " 1916	793 14 2		" Postage Expenses	301 5 2	
" " the current year	19,414 18 0		" Library Account	146 2 9	
" " 1918 (in advance)	649 9 0		" Furniture	15 12 0	
" " 1919	15 0 0		" Expenses on Account of General Keary's Specimens	18 8 0	
" Life Membership	200 0 0		" Sundries	59 5 0	
			" Auditors' Fee	130 0 0	
Less—Refund of Subscription ..	31,423 4 8		" Amount advanced to Mammal Fund ..	400 0 0	
	106 15 0		" Advanced for Cartridges for Capt. Buxton ..	100 0 0	
			" Income tax	139 0 7	
			" Insurance paid on Microscope	56 4 0	
			" Insurance Premium	140 10 0	
			" Bank Charges	65 4 0	
			" Investment in 6½% Indian War Loan ..	10,000 0 0	85,186 6 10
		31,317 5 8			
			" Advance to Staff for War Loan	1,031 13 0	
			Less—recovered	149 10 4	832 1 8
			Balance—		
TO Entrance Fees	930 0 0		Cash in hand	47 13 9	
" Sales of Journal	1,488 7 7		Balance as per Postage	54 5 6	
" " Snake Books	1,189 2 0		" Petty Cash	25 18 2	
" " Catalogue of Library	4 0 0		" " with National Bank	2,517 8 9	
" " Pigeon Books	207 11 4				
" " Mr. Chhibber's Paper	875 7 0				
" " Artists Copies	25 10 6				
" " Manuscripts Notes	13 0 0				
Carried over	4,168 15 6	27,019 2 8	Carried over		2,945 2 2
					Rs. 86,968 11 8

RM. 88,088 11 8

Examined and found correct.

(Sd.) A. F. FERGUSON

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(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants, Auditors.

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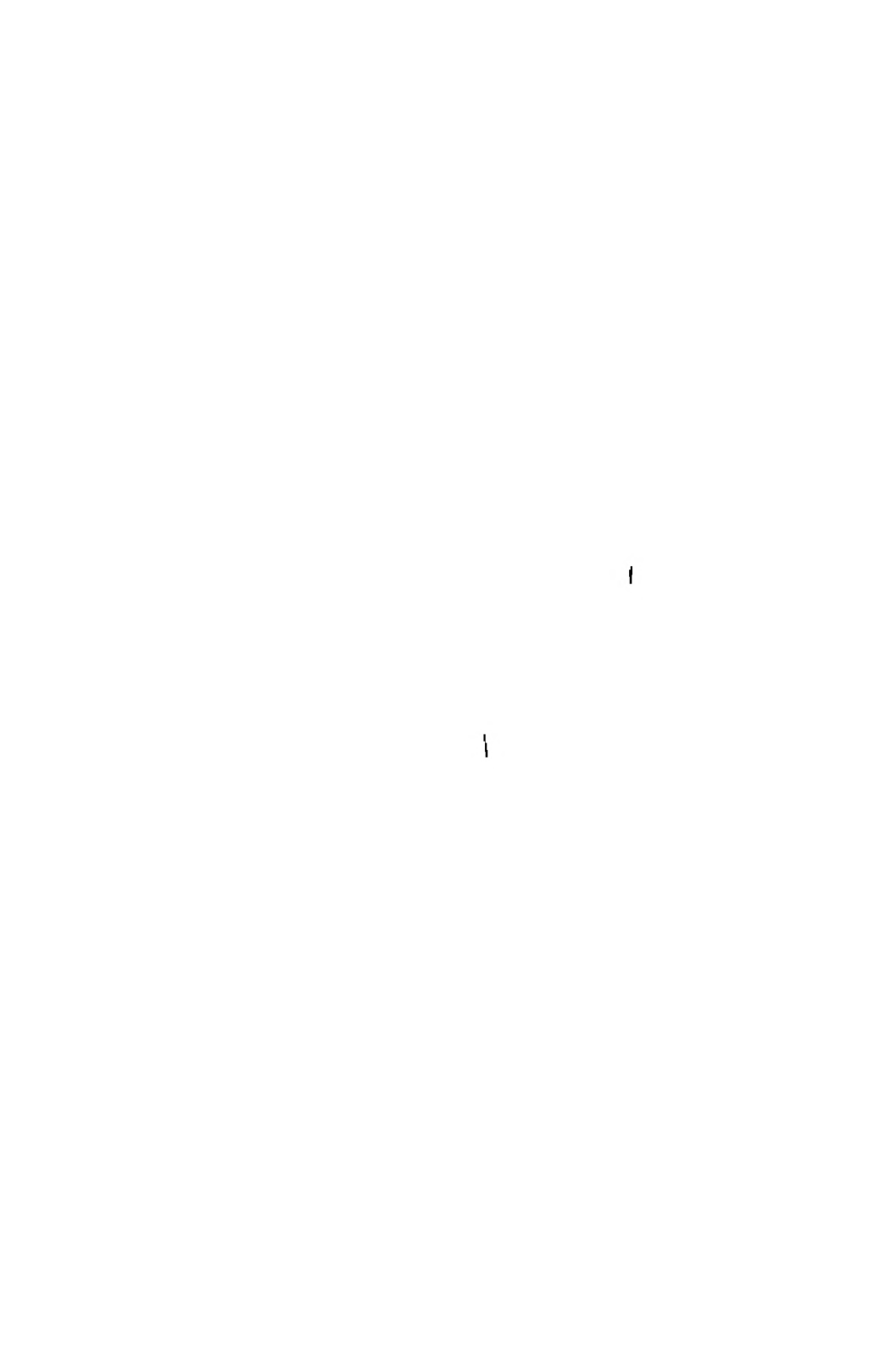
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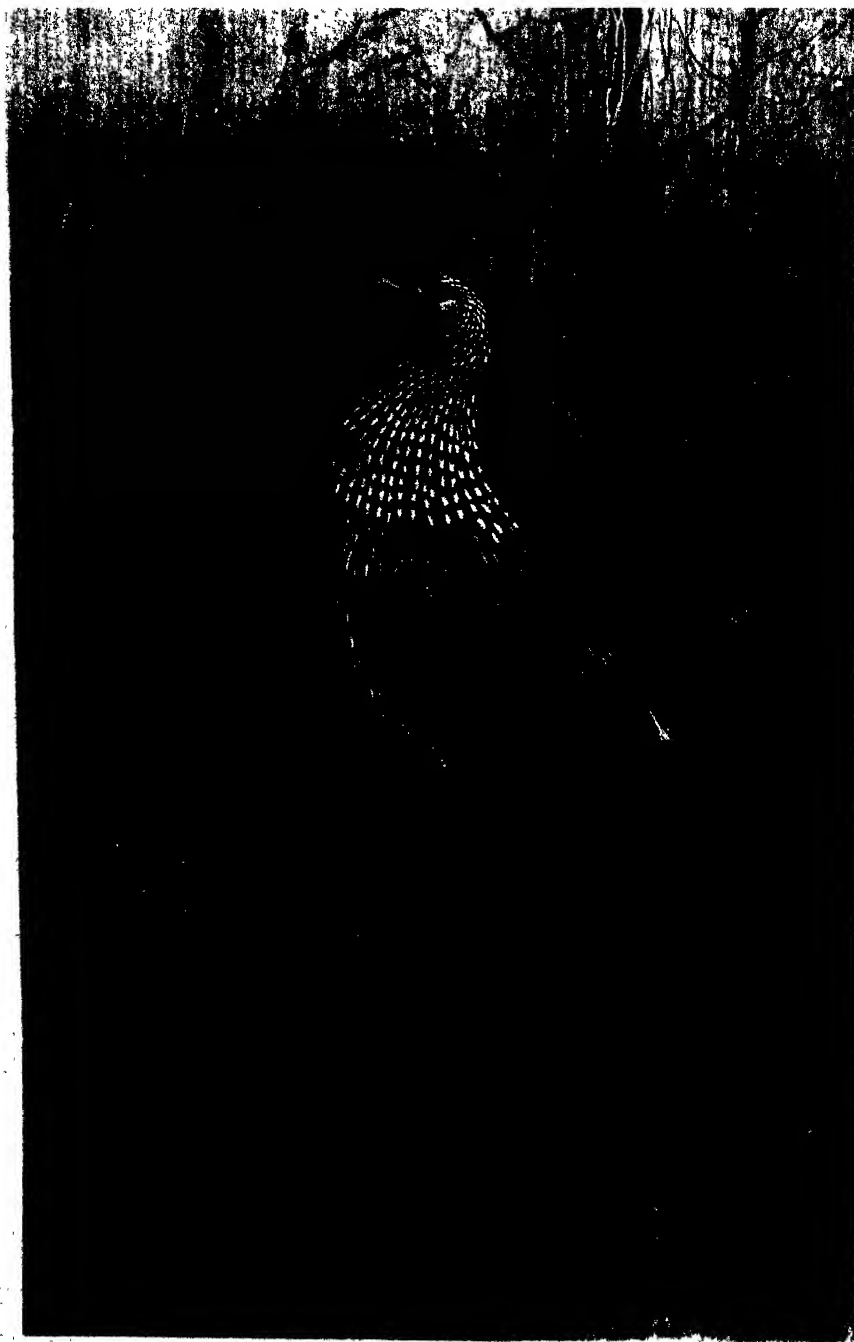
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THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U.

PART XXI.

With a Coloured Plate.

PHASIANIDÆ.

Genus—*GALLUS*.

The Genus *Gallus* contains the true Jungle-fowl, of which there are four species entirely confined to the Indo-Malayan region. Jungle-fowls are closely allied to the true pheasants, like them the sexes differ in plumage, the males greatly exceed the females in size, and their haunts are well-wooded tracts with an ample water supply. The principal external difference is in the tail which in the Jungle-fowl is sharply compressed whereas in the true pheasants it is flat; it is linked however with these latter by many intermediate forms such as *Gennæus*, containing the Silver and Kalij Pheasants, *Crossoptilon* or Eared Pheasants, etc., in which the tails are almost as compressed as in the Jungle-fowl.

The males are all furnished with a fleshy crest or comb and with wattles or lappets either hanging from each side of the throat, as in all three of the Indian species, or with a single one from the centre of the throat as in the Sunda Island bird, *varius*. The tail consists of fourteen feathers in our three species and of sixteen in the last mentioned bird. The wings are well rounded, the first primary being shorter than the tenth and the fifth the longest. The central tail feathers in the male are greatly lengthened, being from three to four times the length of the outermost, the shafts are pliant

over the greater portion, and the feathers droop in a graceful curve when the tail is raised. The feathers of the neck and rump are long and lanceolate, forming hackles, the latter falling well down on either side of the tail. The legs are very powerful, and the tarsus, which is furnished with a long shaft spur, is longer than the middle toe and claw together. The females have no spur.

KEY TO SPECIES.

- A.—Comb and spurs highly developed.
- a. Neck-hackles red or golden-red with no spots.
 - a¹. Breast black *G. bankiva* ♂.
 - b¹. Breast reddish orange *G. lafayettei* ♂.
 - b. Neck-hackles blackish with golden bars or spots *G. sonnerati* ♂.
- B.—No spurs and comb rudimentary.
- c. Breast rufous-brown with faint pale shaft lines *G. bankiva* ♀.
 - d. Breast mottled brown and black and white *G. lafayettei* ♀.
 - e. Breast white, each feather edged with brown *G. sonnerati* ♀.

There are two very distinct races or subspecies of the Common Red Jungle-fowl inhabiting the one India proper excluding the Indo-Burmese districts and the other extending through Burmah, the Malay Peninsula, Cochin, China and Siam. In the outer Burmese Indian districts of Eastern Assam and Chittagong we find, as we should expect, an intermediate form between the two.

The Indian form may at once be known by its pure white lappets, the Burmese form having these red, but there are other differences also, the Indian bird, the true *ferrugineus*, has the hackles of the neck of a red much less deep than they are in the Burmese bird, moreover they are far more yellow or orange-yellow at the base of the neck, and in addition are more lanceolate, the Burmese form often having the ends comparatively broad instead of produced to a very fine point.

Hume recognised the differences between the Burmese and Indian bird, and thus writes of them:—

"I have referred to the Indian and Burmo-Malayan races of this bird. The plumage of the latter is said to be redder, and taking a large series there seems to be some truth in this, though individual birds from Dehra Dun and Johore, for instance, can be entirely matched as regards plumage, but in the Burmese and Malayan birds, the small ear lappet is invariably red, whereas in the Indian it is almost equally invariably white or pinky white."

The Burmese form will be known as *Gallus bankiva bankiva*, Temm.

• KEY TO SUB-SPECIES

- A.—Ear lappets white *G. b. ferrugineus*.
 B.—Ear lappets red..... *G. b. bankiva*.

The Red Jungle-fowl is generally accepted as the original ancestor of the domestic fowl, but there is really nothing to prove this beyond the fact that the wild Red Jungle-fowl is extremely close in appearance to the domestic bird of the Game-cock strain. On the other hand Seabrights pencilled Hamburgs and many other domestic strains which are known to be of artificial origin are much more like the Grey Jungle-fowl than the Red. Remains of extinct and fossil birds placed in the genus *Gallus*, have been found in many countries in Europe and also in New Zealand, which date back to the Pleocene and Pleistocene periods and the most that can be said concerning the origin of the domestic fowl is that it is probable that its immediate ancestor may have been something like the Red Jungle-fowl.

I have followed Blanford in not accepting *Gallus gallus* as the name of the Wild Indian Jungle-fowl, but as *bankiva* is an older name than *ferrugineus* the species must be known by this name, the Indian race or sub-species taking the trinomial *ferrugineus*.

[*GALLUS BANKIVA FERRUGINEUS*.

The Common Jungle-fowl.

Phasianus gallus.—Linn, Syst. Nat. I, p. 270 (1766).

Gallus bankiva.—Jardine, Nat. Lib., Orn. iv., p. 175, pl. (India); Hodgs. in Gray's Zool. Misc., p. 85; Gray, Cat.; Hodgs. Coll. B.M. ed. i, p. 125; Adams, P.Z.S., 1858, p. 498; Blyth, Ibis 1867, p. 156.

Gallus ferrugineus.—Blyth, Ann. Mag. N. H. XX, p. 387 (1847); *id.* Cat. Mus. As. Soc., p. 242; Adams, P.Z.S., 1859, p. 185; Irby, Ibis 1861, p. 234; Jerdon B. Ind. iii., p. 536 (part); Blyth, Ibis 1887, p. 154 (part); Beavan, Ibis 1868, p. 381; Brooks, Ibis 1869, p. 60; Bulger, Ibis 1869, p. 170; Elliot, Mon. Phas. ii., p. 184, pl. 32 (part); Hume, N. & E., Ind. B. p. 528 (part); Ball, Str. F. II., p. 426; Hume, Str. F. ii., p. 482 (part); Blyth and Walden, Cat. Mam & B. Burma, p. 149; Hume Str. F., *ibid* III., p. 171; Armst. IV., p. 338; Hume and Inglis, *ibid* V., p. 44; Oates, *ibid* V., p. 164; Wardlaw-Ramsay, Ibis 1877, p. 468; Marshall B. Nest Ind. p. 59; Hume and Marshall, Game B. Ind. I., p. 217 pl.; Anders, B. W., Yunnan, p. 669; Hume and Davison, Str. F. VI., pp. 442, 521, Ball., *ibid* VII., p. 225; Hume, *ibid*, VIII., p. 68; Scully, *ibid*, VIII., p. 348; Bingham, *ibid* IX., p. 195; Fasson, *ibid*, IX., p. 205; Oates, *ibid*, X., p. 236; Marshall, Ibis 1884, p. 423; Taylor Str. F. X., p. 531; Hume, Str. F. XI., p. 304; Oates, ed. Hume's Nests and Eggs. III., p. 417 (part); Blanf., Avi. Brit. Ind. IV., p. 75 (part); Sharpe, Hand-L. B. I., p. 39 (part); Stuart Baker, Jour. B. N. H. S. XII., p. 436 (1899); Inglis, *ibid*, p. 676 (1899); Fulton, *ibid*, XVI., p. 61 (1904); Ward, *ibid*, XVII., p. 944 (1907); Inglis, *ibid*, p. 971 (1907); Magrath, *ibid*, XVIII. p. 298 (1908); Osmaaston, *ibid*, XXII, p. 544 (1913).

Gallus gallus.—Ogilvie-Grant, Cat. B. B. M. XXII, p. 344 (part); *id.* Hand-L. Game B. II, p. 48 (part); Oates, Journ. B. N. H. S., X., p. 106; *id.* Game B. of In. (part) I.; p. 366.

Vernacular Names.—Jungli Murgha, Bun Murgha ♂, Jungli Murghi, Bun Murghi ♀ (*Hin. Upper India*); Bunkokra, Bunkukra, (*Bengali*); Bun kukur (*Assamese*); Natsu-pia, Magse-ya (*Bhutia*); Pazok-tchi, Tangkling (*Lepcha, Sikkim, Doonars*); Bir-sim (*Koles*); Gera-gogor ♂, Kuru ♀ (*Gonds*); Lall (*Chanda Dist.*); Ganga (*Uriya*); Daono (*Cachari*); Vok (*Kuki*); Inrui (*Kacha Naga*).

Description—Adult Male.—Crown of the head, nape and upper mantle, together with the sides of the neck, deep bright orange-red, changing to reddish gold or orange on the longest hackles, which are marked with black down their centres; upper back, below these long hackles, black glossed with Prussian blue or green; lower back deep maroon red, highly glossed and gradually changing into fiery orange on the long hackles of the rump; these latter are more or less centred with black, the centres, however, being concealed by the overlying feathers; upper tail-coverts and tail-feathers black brilliantly glossed with green, blue-green or copper green; the blue generally dominant, on the coverts, and the gloss absent or slight on the outermost tail feathers. Smallest wing coverts, and shoulder of wing black, glossed like the back with blue or blue-green, or purple-blue; median wing coverts like the lower back; greater coverts black like the smallest; quills dark brown, in some specimens almost black; the primaries edged on the outer web with light cinnamon and the secondaries with the whole of their visible portions of this colour except the innermost which are of a glossy blue-green with only a part of the outer webs cinnamon.

Under plumage, under wing-coverts and under tail-coverts deep brown or blackish, faintly glossed with green.

Colours of soft parts.—Irides varying from reddish brown in the young bird, through red to bright orange red in old males. Comb generally a bright scarlet crimson, sometimes duller, more red and sometimes almost a brick-red; wattles the same in colour, but sometimes a more livid red; ear lappets white, sometimes touched with pinkish on the lower posterior portions, especially in Assam birds; skin of face, throat and upper neck red, generally of a rather bluish or fleshy tint; legs vary between greenish grey and a deep slaty brown, every intermediate tint being met with, the most common colour being a rather dark plumbeous with a faint tinge of brown or purple; the spur is always more or less brown, almost black at the tip. Bill dark horny brown, the gonys and tip of the lower mandible paler and the former often reddish. The colour of the comb and wattles is much brighter in the breeding season than at other times, both in the male and female, just as it is in barn-door hens when they are in full laying.

Measurements.—Wing 8" (203·2 mm.) to 9·6" (243·8 mm.); tail anything between 12" (304·8 mm.) and 15" (381·0 mm.); tarsus about 3" (76·2 mm.) or rather more; bill from gape about 1·25" (32·6 mm.) and from front about ·80" (20·3 mm.); the spur is generally about an inch (25·4 mm.) but I have seen one or two specimens with spurs a full 2" (50·8 mm.). Weight, according to Hume, 1lb. 12ozs. to 2lbs. 4ozs., but one male shot by me in Cachar weighed only just short of 3lbs. and two or three others well over 2½lbs. The majority weight just under, rather than over, 2lbs.

Post nuptial plumage.—The cock Jungle-fowl has a sort of post nuptial plumage caused by the moult of the neck hackles and the long tail feathers, the former being replaced by short blackish brown feathers. Often these same blackish feathers may be observed in patches on other parts of the body, principally the back and wing coverts. These feathers probably replace others lost by accident or some other abnormal cause.

This post nuptial plumage is interesting in that it corroborates the theory that all extraordinary colouration or shape in any portion of a bird's plumage is due to excess vitality and with a drop in the vitality to a sub-normal condition sombre colours or normal shaped plumage is assumed. In many cases this post nuptial plumage is never assumed and cock birds may be shot all the year round in perfect feather. When assumed it is most irregular and may be found in any month between May and October, though generally the hackles are dropped in June and July and reassumed in the September-October moult.

Immature Male has the hackles less developed both on neck and rump, and the black centres to these feathers comparatively broader and far more visible; as a rule also the neck hackles are more yellow and less deep orange in tint. The cinnamon of the wing quills is darker, and the whole of their surface except at the basal halves of the outer webs are finely powdered and vermiculated with blackish; the greater-wing coverts are also more or less powdered in a similar way.

Colours of soft parts.—Iris brown, or reddish brown; wattles and undeveloped comb duller than in the adult, and skin of face bluish or leaden colour.

Quite young Males in their first feathers are similar to females of the same age.

Adult Female.—Top of the head blackish brown, the feathers broadly edged with golden yellow. In most birds the forehead is more or less metallic crimson and this colour is produced backwards as supercilia above and behind the ear coverts whence they widen and meet on the foreneck in a broad gorget. In some specimens the red will be found to occupy nearly the whole of the fore-crown

and to deepen the yellow of the posterior crown to a deep orange. Feathers of the nape orange yellow, with broad blackish centres, changing to pale golden yellow on the longer hackles along the back. Upper plumage, wing-coverts and inner secondaries reddish buff or reddish brown, the feathers with pale shafts and vermiculated all over with black or very dark brown; primaries deep brown or brown, sometimes edged on the outer web with rufus. Tail blackish brown, the central tail feathers more or less mottled with rufus, which in some cases extends to the next two to four pairs of feathers on their outer webs. Breast below the red gorget light Indian red with pale shafts, gradually becoming paler and duller on the lower breast, and shading into pale dull cinnamon on the belly, much vermiculated with brown; under tail covers black or blackish brown.

Colours of soft parts.—Iris brown or hazel; bill horny brown, gape and lower mandible plumbeous fleshy or fleshy grey; comb and orbital skin reddish crimson; wattles very rarely present and very small, like the comb but paler and more livid, legs generally dull plumbeous brown but varying in tint as in the male. Undeveloped spurs are occasionally present. Tickell obtained such a specimen in Singhbhum and I have myself shot at least half a dozen females showing spurs, which in one case exceeded half an inch in length.

Measurements.—Wing 7" (177.8 mm.) to 7.7" (195.6 mm.); tail from vent 5.5" (139.7 mm.) to 6.5" (165.1 mm.); tarsus about 2.5" (63.5 mm.); bill from front about .75" (19.5 mm.) and from gape about 1.1" (27.9 mm.)

"Weight 1lb. 2ozs. to 1lb. 10ozs."—(Hume).

Young females in their first year are generally more yellow buff and less red below and have the feathers boldly mottled with brown on the breast and lower parts. The extent of the crimson or rusty-red of the head is also a sign of age, though a few females seem never to acquire this.

Chick in down.—A broad band down from the centre of the crown to the end of the back a rich plumb brown; a streak of similar colour from the posterior lores produced in a fine line over the eyes and as a wide line down the sides of the neck; lateral bands of buff down each side of the back succeeded by other bands of the same colour at the centre.

Sides of the body rich warm reddish buff changing to pale buff on throat, foreneck and centre of breast and belly.

The wing feathers when they first appear are isabelline finely vermiculated with black, the quills gradually becoming more or less immaculate on the inner webs as they grow larger.

The bills are fleshy yellow and the legs rather clear olive greenish.

Distribution.—Hume's very full note on the distribution of the

red jungle-fowl leaves little to be added. Eliminating the areas in which the Burmese form occurs his summary is as follows:—

“Throughout the lower ranges of the Himalayas, the
“Dhuns Tarais, and submontane districts and the Siwálíks
“from the southern outer ranges of Kashmir to the extreme
“head of the Assam Valley beyond Sadiya.

“Throughout the whole of Assam including the less
“elevated portions of the Cáro, Khasi and Nága Hills, Cachar
“and Sylhet, the whole of Eastern Bengal, including the
“Sunderbans. Again in the hilly portions of Western Ben-
“gal from the Rajmehal hills, through Midnapore, and
“westward of this, through the whole of Chota Nagpore, and
“the northern and eastern portions of the Central Provinces,
“it is the only jungle-fowl that is found. It is common
“along the Kymore Range, and extends northwards to the
“neighbourhood of Punnah and Chairkhari, and south-
“wards on the Maikal or Amarkantak Ranges.

“Southwards and eastwards of these latter, it occupies the
“whole country north of the Godávari, Orissa, the Tributary
“Maháls, Ganjam, Vizagaptam, and part of the Godávari
“District, Joonagurh, Kareall, Nowagurh, Jeypore and
“other Feudatory States. It occurs also immediately below
“Pachmarhi.”

Forsyth has shewn that the habitat of this jungle-fowl is practically that of the Swamp Deer (*Cervus duvauceli*) and of the Sal-tree (*Shorea robusta*) and a curious corroboration of this is the occurrence of all three of these in the Deinwa Valley, near Pachmarhi, although there is an intervening country of some 150 miles eastward before the three are again met with. At the same time it must be noted that the Red Jungle-fowl does not occur in Bhawalpore and Sind where the Swamp Deer is found, though not the Sal-tree.

Nidification.—The Red Jungle-fowl breeds, over the whole of its habitat, the season apparently not varying much in different localities as it does with some birds. Thus even in the hot, dry portions of the Central Provinces and Punjab, etc., they appear to lay from April to June, not waiting until the bursting of the rains ensures more food and a cooler temperature. At the same time it is certain that although the months just mentioned may be the principal breeding months a much wider margin of time than is covered by these must be allowed for their nidification. I have personally taken their eggs in the Santhal Perganas, Chota Nagpore, Assam and Cachar in every month of the year except October, November and December. In the last mentioned month, however, I have seen just hatched chicks, so it would be unsafe to exclude any month of the year from their breeding season. In Assam

undoubtedly most birds lay in March and April, many in February and June and the rest at odd times throughout the year.

I have not known them breed above 6,000 feet, but have taken eggs at this height in the Assam Ranges, and have received a clutch of 8 eggs taken at Simla at this height by Mr. P. Dods-worth, whilst in the Naga Hills and hills in the extreme east of Assam they are found up to 7,000 and even 8,000 feet in summer, and almost certainly breed at this elevation.

They nest in practically any kind of jungle, but undoubtedly prefer for this purpose the dense tangle of secondary growth which is found in deserted cultivation clearings. Next to this kind of jungle, bamboo forest which is dense and which has some undergrowth appears to be a favourite resort and, thirdly, broken hills well covered with dense bush and tree forest. As regards the nest, this may be either a depression scratched in the ground by the birds or a natural hollow sometimes devoid of all lining, or, on the other hand, well lined with fallen leaves and rubbish. Sometimes there is no hollow even, and the eggs are just laid on the ground under the protection of a bush or clump of bamboos, whilst often a mass of leaves, grass and rubbish is collected in a heap, a hollow formed in the centre, and the eggs laid therein. I have also taken several nests made in the centre of bamboo clumps, the eggs being deposited in the mass of leaves and rubbish which always fill up the inside of these clumps to a height of two to four feet.

As a rule the nests are well concealed, especially where they are made in secondary growth, but I have more than once found them so placed that they could be seen from some feet away without any search having to be made for them. One such nest was placed on the ground in a shallow green mossy ravine running through ever-green forest. A certain amount of dead leaves, bracken and moss had been collected in a depression, whence a large stone had been turned out, and on these the eggs were laid, conspicuous from about 20 feet in every direction, except from the point at which they were screened by the boulder which still lay where it had been thrown on one side. Another quite unconcealed nest lay in a very open bamboo jungle, in a small bare space where nothing grew and here on a few dead bamboo leaves lay the five eggs, saved from detection only by their resemblance in colour to the bamboo leaves.

The period of incubation appears to be 20 days, equivalent in tropical countries to the 21 days the domestic fowl takes to hatch her eggs in more temperate regions. The hen sits close, and when forced to leave, creeps away silently through the jungle more like an animal than a bird, though occasionally when very suddenly disturbed she may get up with as much fluster and fuss as a barn-yard fowl.

The number of eggs laid is generally 5 to 8, rarely 9, and whilst 5 or 6 is undoubtedly the usual full complement, often only 4 are laid. Some hundreds of clutches have passed through my hands, or have been actually seen by myself in the nests, and Dr. H. N. Coltart must have seen almost as many, but neither of us have ever known more than 9. Jerdon states that they sometimes lay as many as a dozen, but his zoological notes are not very correct, and he, like many others, who have made similar statements as to the number of eggs laid, have been probably misled by natives. In appearance the eggs cannot be discriminated from those of the common Indian domestic fowl, and only differ from those of the English birds in being so much smaller. They vary in colour from almost pure white merely tinged with cream to a deep cream buff or *cafe-au-lait* tint like that of a Brahma fowl's egg. Now and then one comes across a deep coloured set of eggs covered with white specks and spots, and I once had a clutch of bright pink-buff eggs marked with white blotches and spots over the larger half.

In length 200 eggs vary between 1.56" (39.6 mm.) and 2.05" (26.6 mm.), whilst in breadth the extremes are 1.27" (32.2 mm.) and 1.62" (41.1 mm.) The average of 200 is 1.82" (48.2 mm.) by 1.40" (35.5 mm.) It will be seen that the average size of my eggs is a good deal larger than those of Hume, but is slightly less than those of the British Museum, according to Oates.

So many writers have constantly asserted that Jungle-fowl hens always cackle and call after laying an egg in the same way as the domestic bird does that I cannot pass over the subject without reference. Having read Tickell's and Rainey's remarks in Hume's "Game Birds" I made the most careful investigations, and must say that I have found nothing to support their assertions. It is true that time after time I have heard hens cackling and shouting as if full of pride at the recent achievement of laying an egg, but have never yet been able to find the egg so laid. Again, I have often heard hens when not breeding calling in the same manner, and sometimes several birds in one flock all giving vent to their feelings at once. As a rule I am quite sure the cry is the result of some fright and is merely the hen's way of expressing indignation and not pride. A tiger or leopard stalking through the jungle will often be abused in this manner, and even a jackal may be the mean cause of a similar commotion; often myself when out shooting and stealthily going through the forest I have suddenly come on one or more hens who, after flying a short distance have relieved their feelings by loud and prolonged cacklings. It seems hardly possible that a wild bird full of anxiety for its future young should announce to all the predatory world "here is an egg, come and eat it." It was this inherent

improbability in the idea that first made me investigate it, and I have no doubt that there is no foundation for it in fact.

Another common theory which there seems good reason to doubt is that Jungle-fowl are always polygamous. Hume draws attention to this and says :—

“Lastly, I am quite certain that they are not always polygamous. I do not agree with Hutton that they are always monogamous, because I have constantly found several hens in company with a single cock, but I have also repeatedly shot pairs without finding a single other hen in the neighbourhood.”

There is, however, a good explanation of the first mentioned condition of affairs, for I think that the young cocks leave the family circle before the young hens do, and in consequence the male parent may often be seen in company with half a dozen hens and no cocks, so that whilst one seldom finds hens wandering about by themselves, unless they are incubating eggs, one often comes across young cocks, either quite alone or with one other young cock of like age; probably a brother. It may be that the old cock drives off the young birds, but it is more likely that the latter being of a more roving, independent nature, clear off sooner than the hens.

General Habits.—Jungle-fowl may be found in practically any kind of country in which there is sufficient cover, but there is little doubt that they prefer country consisting of shallow valleys, low hills and broken ground at the foot of big hills rather than open plains country or the higher hills. As already mentioned, they may be found up to, or even over, 6,000 feet, but they are mere stragglers to such heights, and it is below 2,000 feet rather than over that we must look for them if we want them in number sufficient to make the shooting of them a regular business. Another undoubted attraction is cultivation when it borders on forest or bamboo jungle; nor does it seem to matter much what the cultivation is, whether grain, rice, mustard, cotton or chillies. Any kind of crop seems to offer food either in itself, in the insects it attracts or in its semi-open patches which supply an easy hunting ground.

Jungle-fowl are extraordinarily numerous in the Garo, N. Cachar and other hills south of the Brahmapootra, and it is often possible to see hundreds in a morning's or afternoon's wandering. Once when shooting on the Kopoli River, a stream which divides the Khasia and N. Cachar Hills, I must have seen fully 500 birds during the day. It was then early in March, and the flocks of birds had not yet broken up into pairs to commence breeding, and every afternoon and evening they frequented the long stretches of mustard field which run along the banks of the stream. Although

nowhere wide, seldom over a hundred feet or so, these patches often ran for half a mile or more without the break of a patch of forest, and they formed simply ideal feeding grounds for every kind of game, from the Jungle-fowl and barking-deer to elephants and buffaloes. The mustard was high enough to afford good cover, so that in spite of the wiliness of the birds it was possible to obtain quite a good bag by wandering along inside the edge of the jungle, whilst a couple of men beat through the mustard about 20 yards behind one. On the morning in question, whilst the sun was still invisible I had got to the first patch and was about to start along the edge of the forest whilst my men did the beating, when I caught sight of a barking-deer coming out of it and a snap shot with my express turned it over and so commenced a lucky day's shoot.

The shot, however, disturbed every thing close by, so as we were only a few hundred yards from the camp, I sent one man back with the deer and waited for his return. By this time the birds had regained confidence and were out feeding once more and we had hardly started our beat before about a dozen Jungle-fowl were up with a tremendous fluster, and had dived headlong into the forest, leaving a fine old cock on the ground, whilst another bird escaped with a bad scare. A hundred yards further on a second but smaller lot were flushed, and again resulted in a miss and a hit, another cock being added to the bag. After this a quarter mile's slow trudge showed nothing but a glimpse of a couple of hens as they scurried on foot into the undergrowth, too far way for a shot. Then a single cock gets up and is missed and within another 200 yards I managed at last to bring off a clean right and left at two hens, the last of a lot to get away out of the mustard. This sort of thing goes on until by about 9-0 a.m. I have got to the end of the cultivation, and have collected 8 Jungle-fowl, a couple of Kalij Pheasant and one Barking-deer, and have expended some 20 cartridges. Of course the great majority of birds have got up well out of shot, and in one stretch of about half a mile of mustard well over 200 birds must have been flushed without my firing off my gun once. In fact the majority of shots obtained were from tiny patches of mustard which lay so snuggled in the forest that the birds could not see us until we emerged from the forest tract into the cultivation. Even in there, however, as often as not we failed to obtain a shot, though the birds were there in numbers. All we saw as we peeped out of our leafy cover would be the last of a flock as it disappeared, an old cock bringing up the rear of his family, tail and head down as he ran for all he was worth into safety. Of course, on such occasions when it was possible a running shot was taken, and when shooting without dogs and especially when shooting to feed oneself and a hungry crowd of coolies, it is absolutely legitimate to do so or else go without any dinner.

Jungle-fowl are just as great skulkers and runners as are nearly all other tropical game birds of the Pheasant tribe, and almost invariably prefer to seek safety on their legs rather than by wing, in fact except when one has good dogs or can work cultivated ground as above, it is absolutely impossible to get the birds to rise unless a regular beat is organised.

We used to have quite good shooting for from 4 to 6 guns in the N. Cachar Hills with a line of 20 to 40 coolies. Our method used to be for the guns to keep well ahead of the beaters along jungle paths or the beds of streams, a gun on either side of these latter when possible, whilst two other guns went along the extreme wings of the lines. In the mornings and evenings the birds were always found low down in the valleys near the water, and very favourite haunts were the numerous scrub-covered islets which were dotted all along the stream. The line of coolies worked down the stream and about a hundred or two hundred yards up the sides of the hills on either side. The birds generally ran some distance in front of the shouting line of coolies and then broke across the stream, flying up the opposite hill and so giving real sporting shots at good distances. In this way we would sometimes get 30 or 40 birds in a morning and evening, chiefly Jungle-fowl but with a few Black-backed Kalij, an old bambooo partridge or so and perhaps a deer thrown in.

The Jungle-fowl is not an easy bird to kill and flies far faster and takes much straighter powder than a novice would imagine. A friend of mine who came out to India with the well-deserved reputation of being a real good pheasant-shot, at first when asked to do so absolutely refused to go out and shoot barn-door fowls, as he called them. He was, however, eventually induced to go out after Kalij Pheasant, and in the course of this shoot succeeded in firing well behind several Jungle-fowl which were put up to his gun. After this we heard no more contemptuous remarks against them, although, once he had taken their measure he became as fine a shot at these birds as at our home pheasants.

I have never been present at any very big shoots at Jungle-fowl, our shoots being merely scratch affairs got up at a moment's notice when we could get a day or half a day off work, but the railway officials under the leadership of Mr. Vernon Woods used to have an annual Jungle-fowl shoot at which very big bags were made.

A great charm about Jungle-fowl shooting, whether in big beats or alone with a couple of shikaries or beaters is the wonderful variety of game one meets with, both large and small.

It is many years now since Hume warned Griffs as to the necessity for being prepared for any eventuality when shooting small game in heavy jungle, and this warning holds good now just

as it did then. Hume describes how when out Jungle-fowl shooting in 1853 he once ran into a party of four bears, and was at once charged by an old female whom he succeeded in killing, but at such close quarters that he and the bear all fell over together.

More than once I have had to shoot surely old boars who resented my intruding on to their feeding ground and once when I had foolishly left my rifle behind when going for an evening's stroll I had to retire in haste, whilst an ill-tempered cow buffalo grunted and pawed the ground in the middle of a mustard patch I wanted to shoot through. On another occasion I had a still more narrow squeak, walking straight on to a tigress engaged in finishing her meal off a wretched Mikir coolie whom she had killed. She was fortunately full and apparently did not quite understand what the object in front of her was, and eventually was good enough to make off, but as I only had a shot gun in my left hand and was too near her to risk changing it into my right, it was with no small relief I saw her leap to one side and rush away through the grass. The next year, curiously enough, when again Jungle-fowl shooting in the same place, I again saw her, this time at a safe distance, and was enabled to add her to my string of Jungle-fowl and Pheasant.

The crow of a Jungle-cock is quite a game wild sound, very like that of the game bantam; it is, however, always recognisable by its shrill yet full note, and, above all, by its very abrupt termination. In the domestic bird the last note is the one usually prolonged and most dwelt upon, whereas in the wild bird the last note is the shortest. Even in those parts of its habitat where the domestic birds are for the most part so constantly crossed with wild birds that they are to all intents and purposes of the same breed I think the full abrupt note of the really wild bird can be always recognised.

They do not crow much during the cold weather, though even in these months an odd bird or two may be heard throughout the day, whilst nearly every bird within hearing will be heard calling every morning and evening. In the breeding season, however, they not only crow several times just before daybreak and after sunset, but they crow constantly during the day, and are only quiet for the hottest hours between noon and three or four o'clock.

During the breeding season, they do occasionally crow when strutting about on the ground, breathing defiance against every other cock in the neighbourhood, but as a rule they mount some convenient stump, or perch on a bamboo or tree branch and from this point of vantage challenge other birds to mortal combat with many crowings and flapping of wings.

Even, however, when they announce their presence thus to any sportsman who may be near, they are so wily and so sharp of hearing that it takes a very careful stalk to enable one to get a shot.

The slightest snap of a twig or rustle of a leaf and, even is in the middle of a crow, it collapses, and when you arrive the bird has gone. About the only time a Jungle-cock can be caught un-awares is when he is fighting, and then, so intense is his interest in the business on hand that I have known them caught by natives simply throwing a cloth over the two struggling birds.

They are quite as pugnacious in their wild state as any breed of game cocks, and often fight to the death, indeed on some occasions until both birds are *hors-de-combat*. One such occasion came within my own knowledge when my coolies picked up a dead Jungle-cock on the forest path, and just beside it another cock, blinded and so weak that it made no attempt to escape when caught and died before it could be brought into camp. They will also fight with pheasants and other birds, and I was once fortunate enough to see the whole of a fight between a Jungle-cock and a Black-backed Kalij.

At the time this occurred I was seated behind a bamboo clump in a thicket of low bushes watching a Mikir attempting to call up Jungle-fowl. We had been there about ten minutes when his calls—made to simulate a hen chuckling and scratching about for food—attracted a cock who replied by crowing for two or three minutes, after which fluttering down from his bamboo perch, he strutted into the small open piece of ground immediately in front of us. At the same moment a fine cock Kalij also came into the open about five paces away, and without a second's hesitation the cock rushed at him, and taking him unawares bowled him over. The pheasant was, however, much the bigger bird of the two and apparently unhurt, though somewhat confused by the rush tactics of his enemy, at once took up the gauntlet. For a few seconds the two birds faced one another, beaks low down to the ground and tails raised, and then like lightning the Jungle-cock rose and jumped over the pheasant, striking lustily as he passed and making the feathers fly.

No real damage was done by this, and the pheasant wheeling once more faced his active little adversary. Again the two birds walked round like a couple of pugilists, watching intently every movement of the other; heads never more than a couple of feet apart, until one or the other made his effort, with varying success, to pass over the other bird striking as he leapt.

Similar proceedings went on for the next ten minutes, the pheasant occasionally taking the offensive, but seldom with any effect. By sheer weight he now and then succeeded in bowling over his enemy, but slowness in taking advantage of his momentary success always enabled the Jungle-fowl to slip away and again attack. At the end of the time mentioned it was a weary and bleeding pheasant which faced a still alert and fresh Jungle-fowl;

for a few more minutes however he still stuck to his guns, but then turned and fled, only to be at once caught and knocked over again and again as he tried to escape; finally as he again turned to bolt, the cock struck fair, and his spur went right into the nape of the neck, and before he could disentangle himself from his victim, both birds were covered by the Mikir's blanket. When we got them out of the folds of this the pheasant was dead, whilst the cock was almost unharmed beyond a broken spur and a torn comb. To the Mikir's indignation I insisted on the release of the winner of the fight, who at once scuttled off into the bamboos and when at, what he considered, a safe distance flew into a branch and crowed victoriously.

Although I have so frequently come across the birds when fighting, I have never come across a regular fighting ground such as that described by Hume. He writes:—

“No one specially notices the extreme pugnacity of these birds in the wild state, or the fact that where they are numerous they select regular fighting grounds much like Ruffs.

“Going through the forests of the Siwálíks in the northern portion of the Saharanpur district, I chanced one afternoon, late in March, on the tiny open grassy knoll, perhaps ten yards in diameter and a yard in height. It was covered with close turf, scratched in many places into holes and covered over with Jungle-fowl feathers to such an extent that I thought some Bonelli's Eagle, a great enemy of this species, must have caught and devoured one. Whilst I was looking round, one of my dogs brought me from somewhere in the jungle round a freshly killed Jungle-cock, in splendid plumage, but with the base of the skull on one side pierced by what I at once concluded must have been the spur of another cock. I put up for the day at a Bunjara Perow, some two miles distant, and on speaking to the men found that they knew the place well, and one of them said that he had repeatedly watched the cocks fighting there, and that he would take me to a tree close by whence I could see it for myself. Long before daylight he guided me to the tree, telling me to climb to the fourth fork, whence, quite concealed, I could look down on the mound. When I got up it was too dark to see anything, but a glimmer of dawn soon stole into the eastern sky, which I faced; soon after crowing began all round, then I made out the mound dimly, perhaps thirty yards from the base of the tree, and forty from my perch; then it got quite light, and in a few minutes later, a jungle-cock ran out on to the top of the mound and crowed (for a wild bird) vociferously, clapping his wings.

"and strutting round and round, with his tail raised almost like a domestic fowl.

"And here I should notice that although, as has often been noticed, the wild cocks always droop their tails when running away or feeding—in fact almost whenever you see them—yet I believe from what I then and once subsequently saw, that, when challenging rivals, they probably always erect the tail, and I know (having twice so surprised them before they saw me when watching for Cheetul and Sambur from a machan, near water in the early morning) that when paying their addresses to their mates, they do the same during the preliminary struts round them.

"I learned so much and no more; there was a rush, a yelp; the jungle-cock had vanished, and I found that one of my wretched dogs had got loose, tracked me, and was now careering wildly about the foot of the tree.

"Next day I tried again, but without success. I suppose the birds about had been too much scared by the dog, and I had to leave the place without seeing a fight there; but putting all the facts together, I have not the smallest doubt that this was a real fighting arena, and that, as the Bunjara averred, many of the innumerable cocks in the neighbourhood did systematically fight there."

In the Sunderbans, where, as Rainey and Hume both believed to be the case, most, if not all, the birds are derived from tame stock; they are often caught by the cultivators who use a tame cock as a decoy spreading nooses round about him in which the wild birds who come to answer his challenge are caught. This method which is described by Rainey and quoted by Hume is the common way of catching Jungle-fowl over practically the whole of their habitat, but the hill tribes often catch them by nooses just set about and around some small patch which they bait with grain.

They are very hard birds to domesticate, if kept in confinement they soon pine away and die, and if allowed to run about with the farnyard birds they nearly always clear off the following breeding season, though they may continue to haunt the vicinity for some time after they first take their departure. At the same time they often haunt the vicinity of villages attracted, of course, by the surrounding cultivation and by the droppings of grain, etc. In such cases it is no uncommon thing for a cock to take up his abode in some tree or bamboo clump in the immediate outskirts of the village, where he sleeps at night and daily visits the domestic fowls as they wander about in the cultivation. The tame fowls seldom resent his appearance, and when they do it is generally on such a footing, that the attempt is not made to drive him off. It is curious that although in some villages the hens are so

continually crossed with the wild cocks that to all intents and purposes the birds are nothing but wild birds pure and simple, yet the cocks never have the same robustness and fighting ability as the actual wild ones. In appearance they are one and the same birds until one examines the spurs and then it is seen that the spur of the wild bird is generally far longer, finer and cleaner than that of the village bird. One seldom meets with the short bulgy spur in a feral state and the texture also seems to be much harder and closer and naturally, as a weapon, is far more effective.

The strength and vigour with which the Jungle-cock can use his spur is really astonishing; in addition to the cases already mentioned in one of which the neck vertebrae were severed and in the other the eye and brain pierced, I have more than once known them to drive the spur full into their opponent's brain behind the comb, and on another occasion found a cock with his wing broken at the carpal joint. Sometimes so fierce is the blow given that the spur itself gets broken or torn away, and once that is done the owner is no more of use in the ring, however great his pluck and determination.

In spite of what Hume says to the contrary, for the table the qualities of the Jungle-fowl must be rated nearly as high as his pugilistic attributes. When shot round about villages he may sometimes be found to be a foul feeder, though this is not my own experience, but normally his flesh is excellent, even old birds are comparatively tender and sweet, except for their legs, whilst birds of the year are much better eating than are Kalij Pheasants of the same age. Like all game birds they are all the better for hanging when the climate permits, but when it is impossible to keep them for two or three days they should in the alternative be plucked, cooked and eaten as soon as possible after being killed.

Like the domestic fowl the Jungle-fowl is practically omnivorous, but is by preference rather a vegetarian than an insect eater. All kind of seeds, grain, etc., are greedily devoured, and also many kinds of roots, buds and young shoots. Bamboo seeds are a very favourite food, and where there are stretches of bamboo which have seeded and the seeds are beginning to fall, these birds—and others—collect in almost incredible numbers into a very small area. I have known them eat in addition to their ordinary seed and grain diet, worms and small lizards, insects of all kinds, tadpoles out of a little backwater in a hill stream, and, once, I saw a hen rushing about with a small grass snake in her bill pursued by two other Jungle-fowl. Whether they would have finished the snake or not cannot be said, as my appearance on the scene dispersed the meeting. They are very fond of all kinds of wild figs and berries and also of the mowa flower when this ripens and falls to the ground.

As a rule Jungle-fowl feed almost entirely on the ground, scratching about, turning over leaves and fallen rubbish and hunting for their food just as the domestic bird does in the back yard, but I have more than once disturbed them feeding in the *Pepul* and *Banyan* trees, scrambling about on the branches and picking the fruit as they go. They are extremely clumsy birds when thus employed, and seem to easily lose their balance and fall over.

The young birds fly within a very few days of hatching, and when the hen is forced to take wing follow her well and seem to have no difficulty whatsoever in keeping pace with her. At this stage of their development their wings appear to be very large in proportion to their bodies, and their flight is very quiet and soundless compared with the noisy flight of the adult bird.

GALLUS BANKIVA BANKIVA.

The Burmese Jungle-Fowl.

Phasianus bankiva.—Raffl., Trans. Soc., Linn. XIII, p. 319, [Sumatra] (1822). Grand Gaille de la Chine.

Sonn.; Voy. India Orient., II, p. 171 (1782), (China).

Hackled-Partridge.—Lath. Gen. Syn., II, p. 766, pl. 66 (1783), *id.*, Gen. Hist., VIII., p. 307, pl. 129 (Cape P.).

Tetrao ferrugineus.—Gm. S. N., i., pl. 2, p. 761 (1788), China.

Perdix ferruginea.—Lath. Ind. Orn., ii., p. 651 (1790), Africa.

Coturnix spadicea.—Bonnat. Tabl. Encycl. Méth., i., p. 218 (1791), China.

Gallus bankiva.—Temm. Fig. et Gall., ii., p. 87 (1813), Java, iii., p. 654; Steph., in Shaw's Gen. Zoo., XI., p. 198; Horsf., Tr. Linn. Soc., XIII., p. 185; Griff. ed. Ouv., III., p. 20; J. E. Gray, Ill. Ind. Zool. i., 43, fig. 3; Robinson and Kloss, Ibis, 1910, p. 672.

Gallus ferrugineus.—Jerdon, B. Ind. iii., p. 536 (part); Blyth, Ibis, 1867, p. 154 (part); Elliot, Mon. Phas., ii., p. 184, pl. 32, (part); Hume, N. and E., Ind. B., p. 528, part; Kelham, Ibis, 1882, p. 1; Nichols, Ibis, 1882, p. 66; *id.* Ibis, 1838, p. 255; Oates, ed Hume's Nests and Eggs, III., p. 417 (part); Blanford, Avi. Bri. Ind., IV. p. 75 (part); Sharpe, Hand-L.-B., i., p. 39 (part); Bonhote, P.Z.S., 1901, p. 78; Ingram, Nov. Zool., XIX, p. 271; Barton, Journ. N. A. Siam, p. 108; Gairdner and Macolm-Smith, *ibid.*, p. 151; Macdonald, Journ. B. N. H. S., XVII., p. 496 (1906); Baker, *ibid.*, XVII., p. 764 (1907); Harington, *ibid.*, XIX, 309 (1909); *Id.*, *ibid.*, p. 365 (1909); *Id.*, *ibid.*, XX, p. 1010 (1911); Cook, *ibid.*, XXI, p. 625 (1912); Hopwood, *ibid.*, XXI, p. 1214 (1913).

Gallus gallus.—Ogilvie-Grant, Cat. B.B.M., XXII., p. 344 (part); *id.* Hand-L. Game B., II., p. 48 (part); Oates, Game B., of In. i., p. 366 (part).

vernacular Names.—Tangkiet (Burmese).

Description.—*Adult Male*.—Differs from the common Indian Jungle-fowl in having the ear lappets red instead of white. The plumage above is generally a deeper red, the neck hackles being less of a golden yellow or orange at their tips. It is also noticeable that the neck hackles are less attenuated and broader at their tips, though the characteristic is very variable, and may in some instances be due to an admixture of domestic blood.

Measurements and colours of soft parts do not differ from those of the Indian bird except for the ear lappets, as already stated.

Adult Female similar to that of *Gallus b. ferrugineus*.

Young Male and Chick in down cannot be distinguished from the same stages in the Common Indian Jungle-fowl until after the first autumn moult, when the deep red of the upper parts at once becomes noticeable. The white ear lappets are replaced by red or deep pink even in very young birds, and will always suffice to show to which sub-species a specimen belongs.

Distribution.—The whole of Burmah and the Malay Peninsula, Siam, Cochin, China, Sumatra and also Java, and many of the Islands of the Malay Islands, as well as in the Great and Little Cocos. In the Cocos the birds are certainly descended from tame stock, and probably in the majority, if not all of the Malay Islands, their origin is the same.

Nidification.—The Burmese Jungle-fowl appears to breed principally in the cold weather, from November to March, but in the hills rather later than this, generally in March and April. Even here, however, it is often a very early breeder, for Harington tells me that he found them breeding in January and February in the Chin Hills, obtaining hard-set eggs in the former month and young chicks in the latter. Mr. C. B. Moggridge found broods of young birds as early as the 10th and 14th of January. In Pegu, Oates found them breeding from the end of February or beginning of March on into June and my collectors took eggs here as late as July, whilst Mr. Barton records finding a bird sitting on six eggs at Raheng in Siam on the 11th March. In the Malay Peninsula they are said to lay during February, March and April, and I have received eggs laid in these months from the vicinity of Taiping.

There is nothing to distinguish either nest or eggs from those of the Indian bird. Oates says:

“As a rule she makes no nest, but merely scrapes out a hollow at the foot of a bamboo or other bush; at times there appear to be a good many leaves under the eggs. These vary in number from 6 to 9; but Captain Wardlaw-Ramsay once found 11 eggs in one nest; in colour they are pale buff.”

Mr. C. S. Barton, to whom I have already referred, records finding a nest containing 6 eggs in an old stump. This is the only record I can find of the bird building off the ground, though it doubtless sometimes makes its nest in clumps of bamboos just as the Indian Jungle-fowl does.

The usual number of eggs is 5, 6 or 7; often they only lay 4, and on the other hand 8 or 9 may sometimes be found.

In size, shape and texture they differ in no way from those of the Indian bird.

General Habits.—The Burmese Jungle-fowl seems to differ in

character from the Indian Jungle-fowl more decidedly than it does in outward appearance, and is probably even more closely allied to the domestic fowl than is the latter bird. It is on the whole less wild, less of a skulker, and far more amenable to restraint and domestication, for several writers record successfully rearing and keeping these fowls together with their barn-door fowls.

A regards choice of country to live in both Indian and Burmese forms seem to have similar likings. Oates writes :

"There is no description of jungle from which this common bird is absent; but if it has a predilection for any particular style of country, it is for the broken ground and ravines with dense vegetation. In these localities (and there are many such, especially at the foot of some of the Hill ranges) it is abundant to a degree. Considerable numbers are generally found together, the two sexes mixing freely together. In Burmah, I think, Jungle-fowl are more common near tiny villages in deep forest than elsewhere, for in the neighbourhood of these hamlets there is always a certain amount of paddy land, a good deal of low cover, and a running stream. They feed in the mornings and evenings, and during the middle of the day they remain very quiet, either in some tree or well-concealed under low bushes or grass."

Mr. C. B. Moggridge (in a letter to the late Col. Harrington, which the latter had kindly made over to me with all his own notes) confirms what Oates says, and also emphasises the Jungle-fowl's love of cultivation. "Anyone who has done much Jungle-fowl shooting soon learns to tell at a glance where the birds will fly when put up, but if one does not know the ground one is apt to take the first open space one finds, if it is fairly clear all round for shooting, with disastrous results. The two best places I know are in Gargaw and Madaya, but the former is the better as there are places where both sides of the creek are cultivated for miles, not with paddy, but in gardens. Here the favourite haunts of the birds were in Lu, a species of grain (*Milium paspalum*), Kanna (Sesamum) and in gardens where a few Zeethe bushes had grown up among the others. All round the villages in Madaya you would find just as many birds as in Gargaw, but between the villages is where the latter gains, the cultivation extending so much farther. We always found the beating very easy where there was a creek to stand in or beat over. Jungle-fowl like staying near water, and seem to haunt trees and bushes on the banks of the creeks, not only because of the water itself, but also because they prefer a clear space in which to spread their wings as they fly down from their nests, rather than having to dive down in and out through the branches of trees and bushes. At one place in the district, Mr. P. E. Cleaver got 27 birds to his own gun in one day."

Jungle-fowl are probably more numerous in suitable places throughout Burmah than they are anywhere in India, for the gentleman above quoted in other letters writes :—

“ Bell and I in 1904 in eighteen days shot 360 Jungle-fowl
 “ and in 1905 in thirty days got 435 birds. The number of
 “ days mentioned represents the total number of days we were
 “ out in camp, and on some of these days we did not shoot at all,
 “ being in jungles away from cultivation, etc. All our shooting
 “ was done as we were on the march from one camp to another,
 “ and no day was taken off work and devoted entirely to shoot-
 “ ing. Under the same conditions as the above, and being
 “ quite by myself, I shot whilst moving from one camp to
 “ another between the 8th of January and end of February
 “ 1910, 316 head of game, of which 127 were Jungle-fowl.”

They also seem to collect in larger flocks in Burmah than they normally do in India. In the latter place I have sometimes seen a couple of hundred in the same stretch of cultivation, but they were all broken up into flocks of a dozen or less, and anything over this number was quite exceptional. Davison and Hildebrand on one occasion counted 30 males and females seated on one enormous bent bamboo. This was in Pahporm in Tenasserim where Davison found them extremely abundant. Again near Bhamo Major Whitehead once counted 40 birds together, but these were all cocks without a single hen.

These cock-parties are not unknown in India where young unpaired cocks often seek each other's society and assemble in small flocks of half a dozen or so, but I have never myself come across so large a party as Major Whitehead's, nor have I any similar record from any other observer outside Burmah.

In regard to its food there is nothing special to remark upon, and as an article of diet itself it appears to be much the same as its Indian brothers and sisters.

The crow is said to be distinguishable from that of the Indian Jungle-fowl, and to be more like that of the domestic bird, *i.e.*, with the last note more prolonged and the crow as a whole less short and jerky.

GALLUS SONNERATI.

The Grey Jungle-fowl.

Coq et Poule sauvage des Indes. Sonn. Voy. Ind. Orient, II., p. 148, pls. 94-95 (1782).

Wild cock.—Lath. Gen. Syn., II., p. 698 (1783).

Phasianus gallus.—Scop. (nec Linn.), Del. Flor. et Faun. Insubr. pl. II., p. 93 (1786); Lath. Ind. Orn., II., p. 625 (1790).

Sonnerat's Wild Cock.—Lath., Gen. Hist., VIII., p. 181 (1823).

Gallus sonnerati.—Temm. Fig. et Gall., II., p. 246 (1813); III., p. 659; Steph. in Shaw's Gen. Zool., XI., p. 200, pl. XII.; Temm. Pl. Col. V., pls. 1 and 2; Griffith's ed. Cuv., III., p. 19; Sykes, P. Z. S., 1832, p. 151;

Jard., Nat Lib. Orn., p. 186, pls. XI. and XII.; Blyth, Ann. Mag. N. H. XX., p. 388; *id.*, Cat. Mus. As. Soc., p. 248; Burgess, P. Z. S., 1855, p. 29; Jordon, B. Ind., III., p. 539; Bulger, P. Z. S., 1866, p. 571; Blyth, Ibis, 1867, pp. 154, 307; Elwes, Ibis, 1870, p. 528; Elliot, Mon. Phas., II., p. 34; Lloyd, Ibis, 1873, p. 401; Hume, N. and E. Ind. B., p. 531; Butler, Str. Fr., IV., p. 5; Fairb., *ibid.*, IV., p. 262; Hume, *ibid.*, IV., p. 404; Butler, *ibid.*, V., p. 222; Fairb., *ibid.*, V., p. 409; Marshall, B. Nests Ind., p. 59; Gould, B. Asia, VII., p. 56; Hume and Marsh, Game B. Ind., I., p. 231, pl.; Davidson and Wend, Str. Fr., VII., p. 86; Butler, Cat. B. Sind, p. 53; McInroy, Str. Fr. VIII., p. 493; Vidal, *ibid.*, IX., p. 76; Butler, *ibid.*, IX., pp. 205, 421; Davidson, Str. Fr. X., p. 316; Davison, X., p. 409; Swinh. and Barnes, Ibis, 1885, p. 131; Taylor, Str. Fr., X., p. 464; Terry, *ibid.*, X., p. 479; Oates, ed. Hume's Nests and Eggs, III., p. 420; *id.*, Game B. of In., I., p. 364; Blanford, Avi. Brit. Ind., IV., p. 78; Sharpe, Hand-L., I., p. 35; Ogilvie-Grant, Cat. B. B. M., XXI., p. 350; Barnes, B. N. H. S. Jour., VI., p. 3; Davidson, *ibid.*, XII., p. 63 (1898); Betham, *ibid.*, p. 363 (1900); Ferguson, *ibid.*, XVI., p. 3 (1904); Finn., Avi. Mag. Feb., 1910, p. 129.

Phasianus indicus.—Leach, Zool. Misc., II., p. 6, pl. 61 (1815).

Vernacular names.—Jungli-murgha ♂, Jungli-murgi ♀ (*Hindus*); Komri (Mt. Abu); Pardah-Komri, (*Gondhi, Chanda Dist.*); Ran-Kombada ♂, Ran-Kombadi ♀ (*Marati*); Kombadi (*Deccan*); Kattu-Kozli or Koli (*Tam.*); Adavikode (*Telegu*); Koli, Kad-Koli, (*Canarese*); Geera-Kur (*Marie Gond*).

Description.—*Adult male*.—Feathers at the sides of the forehead dull rufous; head, neck and hackles of the extreme upper back black with grey, fringes to the bases, and with numerous bars changing from golden yellow on nape and shoulders to pure white on the back; on the longer feathers the black bars are glossed with purple blue. Feathers of the back, rump, and lesser wing coverts black fringed with gray, and with broad white shaft streaks, the majority also with concealed longitudinal grey bars. Longest and lateral rump feathers highly glossed with purple and with chestnut instead of grey fringes, in addition to which they are marked with pale yellow or white spots. Upper tail coverts black glossed with violet, purple and blue, and edged with chestnut and buff.

Median wing coverts and scapulars black, barred on the basal half with grey and with white shafts which expand at the tips for a length of about an inch into spatulate, flat plates of orange yellow about two inch wide; the majority of which have fringes on the outer side of deep red. Greater coverts and quills blackish brown, the innermost quills and coverts with white shafts, and sometimes a small amount of whitish freckles near the tip. Lower parts from the hackles to vent dark grey brown to black with broad white shaft stripes and grey or grey-white edges; feathers of posterior flanks and a few of those on the abdomen with orange rufous edges. Feathers of vent and centre of abdomen dull rufescent brown; under tail coverts black with white edges.

Colours of soft parts.—"The legs and feet are yellow, or reddish yellow, and the claws black, but I have one specimen, probably a young bird, noted as having had the legs and feet greenish brown.

The bill is in the adult, more or less of it, black, the upper mandible often yellowish at the base, and the lower mandible also pale horny, but in younger birds the upper mandible is horny or greenish brown, and the lower mandible yellow. The irides of the adult are yellow or reddish orange, occasionally bright red, in younger birds yellowish brown."—(Hume.)

Finn says that the legs of males in full vigour are a salmon red, and it appears that they are brighter and more red during the breeding season than at other times. The comb, bare face and wattles are crimson, brightest during the breeding season.

Measurements.—"Length 28.0 to 32.0; expanse 27.0 to 31.0; wing 9.35 to 9.65; tail from vent 14.0 to 16.0; tarsus 2.85 to 3.0; bill from gape 1.23 to 1.3; weight 1 lb. 10 ozs. to 2 lb. 8 ozs.; length of spur 1.8 to 1.75 inch."—(Hume.)

The measurements of the birds which have passed through my hands somewhat exceed the above, two cocks having had a wing of full 10 inches (254 mm.) and one or two others nearly approaching it. I have also seen one bird with a tail of 18 inches.

Young male.—Like the female, but much more rufous and more boldly barred and blotched.

Young male on moulting from first plumage and before acquiring hackles has the whole upper plumage black, the feathers grey edged and with white shaft lines; the wings and tails are like the female, but much darker, the underparts are like the adult but without the rufous on the flank and belly feathers. The median coverts and the scapulars where waxy yellow, and spatulate in the adult are marked with rufous in the young bird, and a few of the feather shafts are already somewhat flattened and spatulate.

Colours of soft parts.—Legs dull waxy yellow, or horny yellow, never with any reddish tinge; irides brown or yellowish brown; bill horny, the culmen darker and the base of the upper and whole of the lower yellowish horny. The spurs are generally short and blunt, not exceeding 12 mm. in length.

The rudimentary comb and wattles are dull crimson red, but the face is almost as bright a crimson as in the adult.

The adult cock has a semi-moult during the rains, June to August, and loses his long neck hackles, and the long central tail feathers, the former being replaced by short feathers of dull brown black without the terminal sealing-wax spots of yellow.

Adult female.—Upper part of the head dull pale brown, rufescent on the forehead and the feathers faintly white centred; neck golden brown, feathers white shafted and with brown bands on each web which increase in size on the mantle. Whole upper plumage, wing coverts and secondaries finely vermiculated, pale sandy brown and dull black; tail dull rufous black mottled with rufous on the central feathers at the edges.

Below white, each feather edged with dark brown and more or less speckled with brown inside this edging; flanks mottled sandy brown and brown with broad white central streaks.

Colours of the soft parts.—Irides red or yellowish red in fully adult birds, yellowish brown in the younger ones and brown in birds of the first year. Legs and feet dull waxy yellow or yellowish brown, according to Hume brownish fleshy in younger birds; the soles are paler and the toes, generally, darker than the tarsus; claw dark horny brown or blackish. Bill horny brown, paler at the base of the upper mandible and yellowish white on the whole of the lower. Rudimentary comb and bare facial skin dull crimson or brick red, less dull during the breeding season than at other times.

Measurements.—"Length 18.0 to 20.0; expanse 26.0 to 27.0;

"wing 7.8 to 8.3; tail from vent 6.0 to 7.0; tarsus 2.2 to

"2.55; bill from gape 1.02 to 1.2; weight 1-lb. 9-ozs. to

"1-lb. 12-ozs." (Hume).

Chick in down.—Similar to that of the Red Jungle-fowl, but with the lateral bands almost pure white instead of bright pale buff and the sides and lower parts dull grey instead of rich buff and buff respectively.

Hume considers that the northern birds, Mount Abu, "run rather larger and considerably heavier than the Nilgiri ones." I can find nothing to confirm this, and have seen two bigger birds from the south of Travancore than from anywhere else further north.

Distribution.—In 1898 Blanford thus defined the habitat of the Grey Jungle-fowl, and since that date I have seen no record claiming and any further extension.

"Throughout Southern and Western India in hilly and jungly ground. This Jungle-fowl is found near the Eastern coast

"as far north as the Godaveri, and in the Central Provinces its limit is some distance East of Sirmcha, Chanda and Seoni.

"It is found throughout the Nerbudda Valley west of Jubbalpore, and in parts of Central India and Rajputana, as far as

"the Aravalis and Mount Abu, but no further to the northward or westward. It is met with near Baroda, but has not been

"observed in Kattywar. It is common throughout the Western Ghats and Satpuras, and it is found, though not

"abundantly, on the tops of the Nilgiri and Palni Hills."

Southwards it is found almost, but not quite, down to the extreme south of Travancore.

Nidification.—The breeding season, properly speaking, extends over February, March, April and May over the greater part of this bird's habitat, though Davison writing of the Western Nilgiris records October, November and December as the principal breeding months. As a matter of fact eggs, fresh and hard-set, and young, hatched or nearly fully fledged, may be found in practically

every month of the year. The months in which most will be found are those in which food is most abundant, a matter dependant upon the rains and other climate influences. In Travancore they breed steadily from March to July, and Mr. T. F. Bourdillon took eggs as late as August 20th. They make their nests—when they make any—and lay their eggs in much the same kind of country and jungle as do the Red Jungle-fowl, and, like the latter birds, seem to specially approve of dense secondary growth and bamboo jungle. They breed freely in the Sholas, or small woods, which nestle in the hollows in the Nilgiri Hills, but they also breed in just as great numbers in the vast woods of Travancore and Mysore. Often they lay their eggs in a small hollow, either natural or scratched out by themselves in the shade of some bush or bamboo clump, and the nest consists merely of a slight collection of rubbish and fallen leaves. Sometimes the nest is formed of a mound of such material with a hollow in the centre for the eggs; more rarely it is comparatively well made of sticks, leaves, bamboo-spates, matted together in a solid mass whilst in still more cases it is perched up on a dead tree or stump or a clump of bamboos.

The number of eggs laid is rather a vexed question. Miss Cockburn, who was always extraordinarily lucky in the number of eggs laid by birds with which she came in contact, says that the number of eggs found in a nest is from 7 to 13; Jerdon says from 7 to 10, and Davison says from 6 to 10. On the other hand Mr. J. Davidson tells me that he has never found more than 4 eggs in a nest, and Barnes mentions the number as 6 or 7, occasionally more. Mr. J. Stewart, through whose hands have passed a very large number of Travancore clutches, and who has seen an immense number *in situ* in a letter to me says, "I am sending you a clutch of 7 eggs of the Grey Jungle-fowl, an unusual number, for they generally lay only 4 or 5, and sometimes even less." There is a general tendency to overestimate the number of eggs laid by game-birds, and from the testimony of modern collectors I think it will be found that 4 or 5 eggs is the number most often laid, and that whilst a fair number of clutches of 6 or 7 eggs may be found, more than this is quite abnormal.

The eggs are of course very small, but can be otherwise all matched by varieties of the domestic fowl's eggs. The most common type is fawn, or fawn-buff, but they vary from very pale cream to a rich warm buff, generally quite immaculate, but sometimes covered with innumerable freckles of light brown, and occasionally distinctly spotted and speckled with light brown, dark brown, or reddish brown. In the latter case the spots are generally sparsely and irregularly scattered over the whole surface of the egg and vary in size from that of a pin's head to spots as much as a couple of millimetres or more in diameter. These spotted and freckled eggs

are, however, exceptional, though comparatively a good deal more often met with than they are in *Gallus bankiva ferrugineus*.

As a rule the surface is very fine, smooth and glossy, but they vary from this to a surface which is densely pitted with tiny pores like those found on a guinea-fowl's egg. In shapes they are typical fowl's eggs, but in a large series a fairly wide divergence of shape may be met with, from a long narrow oval almost the same at either end to a broad squat oval with the smaller and distinctly pointed and compressed.

In length the 50 eggs I have measured myself or of which I have had measurements sent me varied between 1.72" (43.7 mm.) and 2.12" (53.9 mm.) in length and between 1.30" (35.0 mm.) and 1.46 (37.1 mm.) in width. The average of the 50 eggs is 1.80" (45.7 mm.) by 1.40" (35.5 mm.).

Oates gives the variation in breadth of the series in the British Museum as being far greater than given above, but I have most carefully measured the series and find them all to come within these limits.

General habits.—Since Davison wrote his splendid description of this bird's habits there has been practically nothing further of value recorded, and so exhaustive and interesting are these notes, that it is not likely that there will ever be much to add.

He writes:

"The Grey Jungle-fowl occurs but sparingly about the higher portions of the Nilgiris, but is common on the lower slopes, in the low country about the basis of the hills, and throughout most parts of the Wynaad. I have found it most abundant in the jungles between Metapolliem and Kullar, and between this place and Burliar about half-way between Kullar and Coonoor, I counted 26 once (while riding up to Coonoor early one morning) feeding along the cart road here.

"Unlike the Red Jungle-fowl, this species is not gregarious, and though occasionally one meets with small coveys, these always consist of only one or two adults, the rest being more or less immature. As a rule, they are met with singly or in pairs.

"The crow of the male is very peculiar, and might be syllabled, *kuck-kaya-kyo-kuck*, ending with a low, double syllable like '*kyukun, kyukun*,' repeated slowly, and very softly, so that it cannot be heard except when one is very close to the bird. Only the males crow, and that normally only in the mornings and evenings, though occasionally they crow at intervals during the day when the weather is cloudy. The crow is very easily imitated, and with a little practice the wild birds may be readily induced to answer.

“ They do not, however, crow the whole year through, but only from October to May, when they are in full plumage.

“ When flushed by a dog in the jungle, they flutter up into some tree above with a peculiar cackle, a ‘*Kuck-kuck-kuck*,’ which, however, they only continue till they alight.

“ They come into the open in the mornings and evenings, retiring to cover during the heat of the day, unless the weather is cloudy, when they may be met with in the open throughout the day.

“ Though found in evergreen forests, they seem to prefer moderately thin and bamboo jungle.

“ Ordinarily, as already remarked, they are found scattered ; but when a tract of bamboo comes into seed, or any other particular food is locally abundant, they collect there in vast numbers, dispersing again as soon as the food is consumed. I remember on one occasion when the undergrowth of the *Sholas* about Pykarra (which consists almost entirely of *Strobilanthes* *sp.*) seeded, the Jungle-fowl congregated there in the greatest numbers. I mean by hundreds, and were excessively numerous for more than a fortnight, when they gradually dispersed, owing, I believe, not so much to the seeds having all been eaten, as to what remained of them having sprouted and so become uneatable.

“ In some ways they are not very shy ; by taking an early stroll, even without a dog, along some quiet road by which cattle and grain pass, several can always be obtained, but when they have been at all disturbed and shot at, they become very wary, and even with a dog, before which they ordinarily perch at once, they are very difficult to secure. In such cases they run till they think they are out of shot, and then rise, and instead of perching, take a long flight, often of many hundred yards, and when they do alight, commence running again.

“ When out feeding they do not usually wander far from cover, and on any indication of danger they dart back into this. They do not, however, go far in, generally only for a very short distance, before stopping to listen, when, if all seems quiet, they reappear in a short time within a few yards of the spot at which they entered. If, on the contrary, after listening they think that there is still danger, they then retreat quietly and silently into the depths of the jungle ; occasionally, after they have got some distance flying up and hiding themselves in some bushy tree.

“ When, however, as sometimes, though rarely happens, they are surprised some distance out in the open, they do not run but rise at once and fly for the nearest cover,

"either perching in some leafy tree, or else dropping to the ground.

"They are very punctual in their appearance at particular feeding grounds, and when one or more are met with in any particular spot, they are certain, if not disturbed in the interim, to be found there again in the same place at about the same hour the next or any subsequent day on which they may be looked for. There was one particularly fine and remarkably shy and cunning old cock that frequented an open glade in the forest (above the Government Cinchona Plantations at Neddivuttum) in the morning, whereas in the evening he always came into the plantation and wandered about under the cinchona trees, and along the plantation roads. He never, to my knowledge—and I must have seen him fifty times at least—came into the plantation in the morning, or into the glade in the evening. There was no doubt as to this being the same bird that frequented the two places (nearly a quarter of a mile distant), for he was the largest, handsomest, and to judge from his spurs, the oldest cock I ever saw. 'I loved that cock as a brother, I did, and at last I circumvented and shot him.'

"The best time to shoot the Jungle-cock is from October to the end of May, as then his hackles are in the best condition.

"In June the moult begins, and the male gradually drops his hackles and long tail feathers, the hackles being replaced by short feathers, as in the female; during the rains the male is a poor mean-looking object, not in the least like his handsome self in the cold weather, and, fully conscious of this fact, he religiously holds his tongue during this period.

"In September, a second moult takes place, the short feathers of the neck are again replaced by the hackles, the long tail feathers reappear, and by October the moult is complete and our Southern Chanticleer as noisy as ever.

"The male usually carries its tail low, and when running, it does so with the tail lowered still more, the neck outstretched, and the whole body in a crouching position as in the Phasianus.

"I do not know for certain whether the species is polygamous or monogamous, but from what I have observed I should think the latter; for although the male does not, I believe, make a nest, yet when the chicks are hatched, he is often to be found in company with his mate and little ones.

"These birds are, I believe, quite untamable, even when reared from the egg, and though in the latter case they may not be so wild as those captured in maturity, they never take

"kindly to domestic life, and avail themselves of the first opportunity for escaping. It is needless to say that they cannot easily be induced to breed in captivity. I have known the experiment tried time after time unsuccessfully.

"Numbers are trapped by the professional fowlers of Southern India and brought for sale, together with *Pavo cristatus*, and *Perdícula asiatica* to the stations on the Nilgiris, where cocks in good plumage may be purchased for about 8 annas each. Numbers are also brought to Madras from the Red Hills, where they are even cheaper. When caught, the eyes are closed by a thread passed through the upper and under eyelids and then knotted together; a short string is then tied to one leg, and the other end made fast to a long stick. A number of birds are placed side by side on this stick, which is then carried about on a man's head. The poor blind birds remain quiet, not attempting to flutter or escape.

"Except for his feathers or as a specimen, the Grey Jungle-cock is hardly worth shooting; the breast alone is really eatable, and even at the best the breast is very dry and hard.

"They roost on trees, continually in the early mornings, just at daylight, when out shooting Sambhur, I have disturbed them from the trees on which they had spent the night.

"Although armed with most formidable spurs, they are not, so far as my experience goes, quarrelsome or pugnacious. In the wild state I have never seen them fighting, and I for many years enjoyed peculiar opportunities for observing them. In captivity half a dozen, with as many females, will live in the same compartment of an aviary in perfect peace.

"Another proof of their non-belligerent character is to be found in the fact that the native bird-catchers never peg males out to attract others, as they do in every part of the East with all birds that are naturally pugilistic. Scores of times I have listened to two cocks crowing at each other vigorously from closely adjoining patches of cover, but neither apparently ever thinking of, as an American would say, *going for that other cock*.

"They are, I think, altogether less plucky birds than the Red Jungle-fowl, and they are so extremely wary, where birds and animals of prey are concerned, and wander such short distances from the edges of cover, that I think very few of them fall victims to any enemy but man. There are plenty of Bonelli's Eagle and some Hawk-Eagles too in the Nilgiris, but I do not think that these ever succeed in capturing Grey, as they do elsewhere Red, Jungle-fowl, at

"any rate, I have never once seen the feathers of *sonnerati* strewn about, as I have those of *ferrugineus* in Burma.

"Their great timidity and watchfulness result in their yielding much less sport than the Red Jungle-fowl. You may get these latter in standing crops and in many other similar situations without any extraordinary precautions, but the Grey Jungle-fowl never goes more than a few yards inside the fields, and if a stick cracks, or a sound is heard anywhere within 50 yards, he vanishes into the jungle, whence it is impossible to flush him. Only when beating the narrow well defined belts of tree jungle that run down the ravines on the hill sides in the Nilgiris, and which we there call 'sholas,' is anything like real sport to be got out of them. Then indeed the gun at the tail end of the shola may get three or four good shots in succession, as they rise at the end of the cover and fly off with a strong well-sustained flight to the next nearest patch. Even thus, working hard and beating shola after shola, a man will be lucky to bag 5 or 6 brace in a day.

"The reason is, that all the well-defined sholas which can be thoroughly beaten are in the higher parts of the hills, where the birds are comparatively rare, while, when you get lower down, where the birds are plentiful, the jungles are so large that they cannot be effectively worked. If you merely want to kill the birds, you might get perhaps 10 or a dozen in a short time poking along some of the roads, but they afford no sport thus, only a series of pot shots.

"I remember once watching an old cock that my dogs had driven up into a tree. For some time I peered round and round (the tree was a large and densely-foliaged one) without being able to discover his whereabouts, he all the while sitting silent and motionless. At last my eyes fell upon him, that instant he hopped silently on to another bough, and from that to another, and so on with incredible rapidity, till, reaching the opposite side of the tree, he flew out silently, of course never giving me a chance at a shot.

"As for food, they seem to eat almost anything; grain, grass seed, grubs, small fruits and berries, and insects of different kinds. I have sometimes killed them with nothing but millet in their crops; at other times quantities of grass seeds, or again, after the grass has been recently burnt, the tender, juicy shoots of the new grass."

GALLUS LAFAYETTI.

Gallus Lafayettei.—Lacép. *Traité d'Orn.*, p. 491 (1831); Des Murs. *Icon. Orn.* pl. 18; Elliot *Mém. Phas.* ii, p. 33. (1873); Hume X. and E. Md. B. 1879; Hume and Marshall. *Game B. Ind.* i., p. 241, pl.; Hume,

Str. Feath. VII., p. 429; Legge, B. Ceyl. III., p. 736, pl.; Oates ed Hume's Nests and Eggs, iii, p. 422; Ogilvie-Grant. Cat. B. B. M. XXII., p. 349 (1893); *id.* Hand-L. of Game B. II., p. 53 (1897); A. L. Butler, Jour. B. N. H. S. x., p. 311 (1896); Lewis, Ibis 1898, p. 339, 550; Blanf. Avi. Brit. Ind. IV., p. 77; Sharp, Hand-L. i., p. 39.

Gallus stanleyi.—Gray, III., In. Orn. III., pl. 43 (1833); Blyth, Cat. B. A. S. B., p. 243 (1849); Jerdon B. of I. III., p. 540 (1860).

Gallus lineatus.—Blyth, J. A. S. B. XVI., p. 357 (1847).

Vernacular names.—Weli-kukula ♂, Weli-kikili ♀ (*Cing.*); Kada Koli (*Tam.*)

Description, adult male.—Crown dull orange rufous; feathers at the base of the naked throat in a patch about an inch long rich violet purple; hackles on neck and upper back orange yellow shading into this from the rufous of the head and again into fiery orange red on the back; the yellow feathers have black central streaks and the red feathers rich maroon ones, the black and the maroon marks grading into one another just as the rest of the colours do. Lower back and rump still darker, almost copper red, the centres to the feathers here being deep violet blue, whilst the central and least lanceolate feathers have also a broad terminal patch of this colour; a few of the longest upper tail coverts all black glossed with blue except for a narrow edge of fiery red. Tail black glossed with Prussian blue or blue-green, never apparently glossed with copper as in *G. b. ferrugineus*. Lesser wing coverts like the hackles of the neck, gradually merging into the median coverts which are like the back; greater coverts black on the visible portions, deep rufous red or mottled rufous and black on the concealed portions. Breast and flanks like the back, the non-lanceolate feathers next the abdomen rufous chestnut with broad black terminal bands; vent and centre of abdomen dull brown-black with paler tips. Thighs black, most of the feathers with narrow chestnut fringes; under tail coverts glossy blue-black.

Colour of soft parts.—"Iris light golden yellow; face, throat and wattles livid or purplish red; comb bright red with a large interior yellow patch, brightest in front and blending into the surrounding colour; bill brownish red, the lower mandible and tip of the upper pale; legs and feet wax yellow, washed anteriorly with brownish, more especially on the toes." (Legge).

Measurements.—"Length of examples with fine tails (which vary in length) 26.0 to 28.0 inches; wing 9.2 to 9.5; tail 13.0 to 15.0; tarsus 3.2 to 3.4; middle toe 1.7 to 1.8; claw (straight) 0.5 to 0.6; bill to gape 1.2. Length of comb from forehead to extremity 3.2 to 3.3 inches; spur 0.7 to 1.2." (Legge).

"In the birds I have been able to measure the wings vary between 8.5" (215.9 mm.) and 9.5" (241.3 mm.) and the longest tail was 16" (406 mm.) whilst others were as short as 9" or 10" (228.6 to 254.0 mm.) "Weight 2-lbs. to 2-lbs. 5-ozs." (Hume).

Young males when they first acquire adult plumage appear to have

the centre of the belly and vent more rufous, the black bases to the feathers hardly showing.

Younger birds still first acquire a certain number of semi-lanceolate feathers intermediate in colouration between the adult and the first plumage; the upper parts from the back to the tip of the tail are dark rufous, vermiculated with black, some of the back feathers showing small violet blue patches. Below the breast is a deep rufous chestnut, slightly barred and vermiculated with black on the upper breast and profusely so on the lower breast where it changes into the dull dirty grey-black abdomen, lower flanks and vent. The under tail coverts are mixed rufous and black.

"Young males in first plumage."—In the bird of the year the iris is light yellowish, the bill much the same as in the chick; the comb and spurs but very little more developed and the wattles are absent. The head and upper part of the hind neck are yellowish rufous, the feathers with darker centres, deepening into chestnut red on the inter-scapular region, sides of neck, and breast; in the lower part of the hind neck the feathers are somewhat elongated, with glossy blackish centres, and there are signs of the dark foreneck patch; the metallic purple of the adult rump is present in small patches on the feathers; the ground colour and tail, which is short, is ferruginous, mottled with blackish, with a greenish black wash on some of the tail feathers; wings blackish brown, the secondaries and their coverts handsomely mottled with rufous and buff; chin and gorge whitish, the feathers very short, lower parts rufescent, tipped with rufous." (Legge).

Adult female.—Forehead dull rufous red, crown dull brown, the feathers finely tipped black, nape, sides of the neck and sparse feathers of the throat dull rufous. Mantle, of which the feathers are far less lanceolate than in *b. ferrugineus*, blackish brown with pale shaft streaks and golden buff edges. Remainder of upper plumage pale buff, rufous buff or rufous brown vermiculated all over with black in fine wavy bars; on the tail the vermiculations are bolder becoming irregular longitudinal barrings and blotches of black glossed with green. Median and smaller coverts like the back, but with sub-terminal bars of black and often white shafted; the greater coverts and edge of wing are boldly barred with black and pale yellow buff; primaries pale brown, mottled on the outer webs with black and buff; outer secondaries brown, boldly barred with black and buff on the outer webs, inner secondaries vermiculated brown and buff along the centre, and boldly barred with black and buff on both webs and with chestnut vermiculations showing here and there.

Below the almost semi-nude throat and foreneck a few feathers of the same black edges take the place of the black patch in

the male; upper breast, sides of the lower breast, and flanks vermiculated black and rufous brown, remainder of breast, belly and thigh coverts white, each feather with a narrow black edging and one or two broad black bands near the visible base. Vent dull pale buff, under tail coverts black and rufous brown, much marked with white in some individuals.

In some females which appear to be much younger birds the rufous brown of the upper breast extends lower down, the brown of the flanks extends on to the breast, and only the centre of this latter is black and white, a few red vermiculated feathers appearing amongst the others. In these birds it is also noticeable that there are no white shaft streaks to the upper plumage, and the general tone is more rufous and less earth-brown. The throat is, of course, comparatively well feathered with downy grey plumes.

Colours of soft parts.—"Iris yellowish olive; bill, upper mandible dark brown, lower yellowish; tarsi and feet brownish in front, yellowish posteriorly." (Legge).

Measurements.—"Length about 13.75"; wing 6.8 to 7.0; tail 3.5; tarsus 2.3 to 2.5; middle toe and claw 2.0 to 2.1; bill to gape 1.1." (Legge).

Wings of the females in the British Museum series and of a few others I have measured have varied between 6.5" (165.1 mm.) and 7.2" (183.8 mm.)

Distribution.—Confined to the Island of Ceylon in which Legge describes its distribution as follows:—

"More or less scattered through the dry jungly districts of the low country, and diffused throughout the hills of the Southern and Central Provinces. It is rather rare in the jungles of the maritime portions of the Western Province and south-western district, and is not common even in the forests of the interior On the eastern slopes of the Morawah Korale where a drier climate prevails it finds a more congenial home, and along the Wellaway River and from that eastward it is numerous. In the maritime portions of the south-east it abounds . . . In the hills it is resident and breeds commonly up to 6,000 feet."

It is perhaps to some extent locally migratory, ranging higher or lower on the hills according to season, but beyond this appears to be resident wherever found.

Nidification.—It is almost impossible to say that the Ceylon Jungle-fowl has any real breeding season, for throughout its range it would appear to be breeding during practically the whole year.

Legge records that in the north of the Island it breeds principally during the early part of the year, but that in the Hambantota district he found young birds in July, others in the neighbourhood of Kadugannawa in December and others again in the Horton

Plains in April, whilst he took eggs in Kukal Korale in August. Again writing to Hume he notes having seen young birds with their parents in the South of the Island as early as February.

Mr. W. E. Wait of the Ceylon Civil Service informs me that "the birds breed more or less throughout the year, and I have eggs taken in the months of February, April, June and August," whilst I have seen others taken in some of the months already mentioned and also January, May and November.

As a rule the Ceylon Jungle-fowl makes its nest of a pile of leaves and fallen rubbish in some natural hollow in forest. In his "Birds of Ceylon" Legge writes:—

"The nest is almost always placed on the ground near a tree, under a bush, or beneath the shelter of a fallen log; a hollow is scratched and a few dry leaves placed in it for the eggs to repose upon. I once found a nest in damp soil between the large projecting flange-like roots of the Doon-tree, containing two eggs partially incubated.

"In 1873 Mr. Parker found a nest on the top of a young tree about 30 feet high. He writes me that it had the appearance of a Crow's or Hawk's nest, of which the Jungle-hen had taken possession. She flew off and three eggs were found to be in the nest."

This curious habit of making its nest at some considerable height from the ground seems to be rather a characteristic of this Jungle-fowl. Many years ago I was told that such was the case by Mr. W. A. T. Kellow and by a Mr. W. Jenkins who collected for me in Ceylon and recently Mr. W. E. Wait again refers to this trait. He says:—

"In one respect I differ from Legge's account of the nesting of the Ceylon Jungle-fowl, or perhaps I should say supplement what he says, for I would add that this bird's nest is quite as often built off the ground as on it. The most peculiar situation I have come across was in an oven-shaped hollow about 8 feet from the ground in a fairly large tree which stood at the edge of a cart track running through the jungle. A big branch had been torn off at its junction with the stem of the tree and the socket had rotted out. In the hollow thus formed four eggs had been laid on a soft layer of touch-wood which had crumbled to dust. On another occasion I came across a nest in a bush overhanging a dry water course. It was a mere depression in a matted platform of dead leaves which had been swept down the water course in some flood, and had been caught up by the overhanging branches.

"A favourite site is a stump of a tree which has been felled and left standing after the tree has been taken away.

“In these cases there is a scanty bed of dead leaves which have
“fallen from the surrounding trees and collected in the hollow
“which generally forms on the upper surface of the stump in
“a very short time.”

Other naturalists who refer to this habit of building in the stumps of old trees are Layard, Parker and Hart, so that it seems to be one well known both to the natives of Ceylon as well as to European observers.

The Ceylon Jungle-fowl lays but very few eggs and we may dismiss Layarde's statement that they lay from 6 to 12 eggs without further consideration. The normal clutch would seem to be 2, 3 being sometimes laid and very rarely 4.

Legge says :—

“I have generally found that the eggs do not exceed 2 in
“number, but sometimes 3, and occasionally 4 are laid.”

And Mr. Wait writes me that his own experience agrees with that of Legge and that whilst he has but one clutch each of 4 and 3 eggs, he has taken many of 2, the majority of which have shown signs of incubation, slight or advanced.

The eggs when seen in a series at once strike one as differing from all other Jungle-fowl's eggs, in that the *majority* are more or less spotted and speckled, whilst some are quite heavily marked in this way.

I have now seen a considerable number of the eggs of the Ceylon Jungle-fowl; 9 in the British Museum series, a fine series collected by Mr. Wait, and a few others collected by Jenkins, Kellow and others and some in the Ceylon Museum.

In colour they are a pale stone, pale yellow buff or cream, in one or two slightly darker, but in none that I have seen do they ever approach the rich buff tint often seen in the eggs of the other species of Jungle-fowl. A few eggs are practically unmarked, but 3 out of 4 differ from those of the Red and Grey Jungle-fowl in being distinctly and profusely spotted with light brown or light purple brown. In some eggs the markings consist entirely of the finest freckles scattered over the whole surface of the egg in such numbers that at a short distance and casually examined the egg looks almost unicoloured; in the majority of eggs, however, the tiny specks are accompanied by small blotches and larger freckles giving them a distinctly spotted appearance, whilst in others the shell is boldly blotched and marked with light brown, a few of the larger blotches measuring as much as 3 to 4 millimetres in diameter.

One egg in Mr. Wait's collection has a pinkish stone coloured ground with numerous very fine freckles of dark red brown and a few small but bold spots and blotches of dark brown.

The eggs in a clutch are not as a rule very evenly coloured, one being generally more spotted than the others, and sometimes

the contrast between the different eggs in the same clutch is very striking.

The texture of the eggs is similar to that of the domestic fowl's egg, and varies to about the same extent. In some it is quite smooth and highly glossed, in others, just as hard and glossy, the whole surface appears to be minutely pitted with tiny pores, and in nearly every such case the pores contain the dark colouring pigment which gives the freckled appearance.

In shape they are remarkably constant, being broad short ovals, the smaller end differing but little from the larger. I have two eggs which are exceptionally long and narrow, and have seen one other which had the smaller end somewhat compressed.

They vary in length between 1.65" (41.9mm.) and 1.95" (49.5 mm.) and in breadth between 1.27" (32.2mm.) and 1.57" (39.8 mm.), whilst the average of 28 eggs is 1.82" (46.2mm.) \times 1.39" (35.3mm.)

The cock is apparently polygamous, though there is no very decided proof one way or the other. At all events, no one has yet discovered him taking an interest in his chicks, a trait which has been observed in the Grey Jungle-cock.

The affection between hen and her chicks and *vice versa* has, however, been more than once commented on, and Legge notes how he once shot a hen whose half-grown chicks ran backwards and forwards about her where she fell until he had come up quite to them. The young would seem to remain with the hen until the succeeding breeding season, although the cock birds again mingle with the hens as soon as their duties of rearing their young are completed.

General habits.—On the whole the Ceylon Jungle-fowl appears to be a bird of the drier parts of the Island, being excessively common in the maritime portion of the south-east coast in the dense Euphorbia Jungles which are there found in long stretches. It is probably resident wherever found, but it possibly only wanders into the highest hills during certain seasons of the year. Legge observes:—

"It is resident and breeds commonly up to about 5,000 feet.

"On the Nuvara-Eliya Plateau and up on the Horton Plains

"it is very abundant during the north-east monsoon, coming

"up from lower down on the hills, and probably to some

"extent from the low country, to feed on the berries of the

"nilloo. It is probable that many remain throughout the

"year in these uplands; but, as I have only visited the Horton

"Plains during the cool season I am unable to say if it is

"found in that locality to any extent during the wet season."

The Ceylon Jungle-fowl seems to be found in all sorts of jungle, in the magnificent tree forest which covers the sides of the hills

and mountains to the low Euphorbia and other scrub jungle found on the sea coast and elsewhere. It is equally common in the bamboo-covered country, and may be found in bush, semi-cultivation, or the dense secondary growth surrounding villages and old cultivation.

They are extremely quarrelsome, pugnacious birds; quite as fond of fighting as the Red Jungle-fowl and far more prone to this diversion than the grey birds. Layard says:—

“The cocks fight most desperately in defence of their seraglios, the combat frequently terminating in the death of one of the engaged parties.”

Their pugilistic tendencies often bring them to grief in other ways, however, for the natives are aware of them and, *vide* Legge, make use of them to decoy them within shot.

“The sound of the flapping of the wings, which is of course the invitation to battle, has the effect of always drawing two birds together and the knowledge of this fact has given rise to the device of imitating the noise, by doing which the sportsman can bring the cock up to him, and if he be properly concealed can easily shoot him. The natives make this sound by clapping against their thighs with the palm of the hand hollowed, but Europeans can best do it by making a pad with the handkerchief and beating it against the palm of the other hand. By this means the exact sound can be made and I myself once procured a very fine specimen in the Osterburgh Woods by adopting this plan.”

I have never heard anyone speak of making a regular business of shooting the Jungle-fowl in Ceylon as sportsmen do with the Grey Jungle-fowl in the Nilgiris and with the Red Jungle-fowl in many districts.

Legge remarks that:—

“This handsome bird, although so very abundant in many parts is by no means easy to shoot. It dwells entirely in cover, and though it is so fond of frequenting the vicinity of paths and tracks through forest, its sense of hearing is so acute that it removes to a safe distance at the sound of approaching footsteps, and though it will continue to utter its challenge cry of “George Joyce”, it gradually makes its way off behind some protecting hillocks or rise in the ground which shuts out the road or path from its view. The north-eastern forests are well suited to its habits, the ground being covered with dry leaves, which do not decay so soon as in the humid jungles of the south; and among these, harbouring a multitude of seeds, insects, and grubs, it scratches exactly after the manner of its domestic race. This scratching may often be heard on a still morning at some

"distance away, and if the bird be behind a mound or little eminence it can be approached if the sportsman is cautious and makes no noise."

Mr. W. E. Wait of the Ceylon Civil Service who has been so good as to send me some very interesting notes on Ceylon game birds, says that he thinks the words "Chuck joy joyce" describes the cry of the Ceylon jungle-fowl even better than does the usually accepted syllables "george joyce." He adds :—

"The cocks often crow in the morning before coming down from the branches on which they roost as I have several times found when stalking a crowing bird. I have generally found them on a branch some 8 to 12 feet from the ground, never very high up, although Legge says that they roost on good-sized branches at a considerable height from the ground.

"Both cocks and hens feed along the grassy strips by jungle roads and paths in the mornings and evenings, especially if the ground is damp after rain. They do not, however, stay out very late, and by about 9-0 a. m. they have all entered into the jungle again, and the cocks have stopped crowing. Sometimes, however, if the weather is cloudy or wet and cool they will stay out feeding all day long, even when it is actually raining. I remember once bicycling over a main road through a forest in the North-Western Province on such a day and within a distance of a mile or less I saw over a dozen birds, mostly cocks.

"Hens with chicks keep more closely to cover than do the cocks, leading their broods about in the undergrowth, uttering a little squeaky metallic chuck as they go, apparently a call note to the little ones. The broods remain together until the chicks are almost full-grown, but I have never seen cocks accompanying hens with chickens. The cocks are polygamous, and I have frequently seen one feeding with two or three full-grown hens, but he sheers off as soon as family duties commence."

It is a very common idea amongst the natives of Ceylon that when the Jungle-fowl eat the seed of the "nilloo", a species of *Strabilesites* which grows from 5,000 feet upwards, they become either blind or drunk, in which condition they are rendered so devoid of all sense or are so incapable that they are often caught. It is rather difficult to say whether there are grounds for this belief or not. Legge wrote to Legge in connection with this belief :—

"About that season of the year if village fowls be brought to the hills they rarely escape a serious eye disease, which spreads throughout a given district, and in many cases becomes totally blind in two or three weeks. This

"is the disease which the Jungle-fowl evidently catch. A dog of mine caught a Jungle-cock with one eye lost, and evidently from this cause."

A collector working for me in Ceylon also once wrote to me that he had caught a cock sitting crouched under a bush, which made no attempt to fly as he approached, and which, when released, tumbled about for a bit on the ground, and then huddled itself up in some grass and allowed itself to be again caught. Nothing was observed to be wrong with this bird physically, but its actions gave it the appearance of being hopelessly intoxicated.

Mr. W. A. T. Kellow also once wrote to me and said that his collector informed him that it was no rare thing for them to catch Jungle-fowl in this—as they termed it—intoxicated condition. It may, however, be that Bligh's explanation is the correct interpretation of these curious cases of apparent intoxication. That there is something which occurs at the time the *Strobilanthes* seeds, which renders the Jungle-fowl practically helpless is vouched for by Legge himself who asserts:—

"Certain it is that at this period the Jungle-fowl in the Horton Plains and about Nuvara-Eliya do become affected, and are apparently so intoxicated that they may be knocked down with a stick."

The crow of the Ceylon Jungle-cock has been described, as I have said above, as a call of "Georgè Joyce" rapidly repeated. This call, according to Mr. Holdsworth, is uttered by the cock as he runs up and down some stout branch, raising and lowering his head at each call. Never having seen the bird in its wild state, I cannot say whether this is correct or not, but when in captivity it undoubtedly "crows" much as a domestic cock does, stretching himself on tip-toes higher and higher as he proceeds, and often flapping his wings both before and after crowing. I have often seen the Red Jungle-fowl crow, and certainly this is the attitude always adopted by them, and it is most amusing to see a fine Jungle-cock caught in the middle of a crow; his triumphant attitude of challenge to the whole world crumples up so instantaneously as he leaps to the ground and skulks off with head and tail down and body as close to the ground as he can get it.

The Ceylon Jungle-fowl is not easy to bring up in captivity, and as a rule does not long survive close confinement. At the same time a good many birds have been successfully reared and domesticated, though I know of no instance in which birds allowed their freedom have not eventually cleared off altogether.

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XV.

(4) THE INDIAN GERBILS OR ANTELOPE RATS.

BY R. C. WROUGHTON.

The group of animals represented by the name *Gerbillus indicus*, in Blanford's Mammalia (No. 264), was recognised as a sub-genus of *Gerbillus*, by Lataste, in 1882 (*Le Naturaliste*, ii. No. 16, p. 126) under the name *Tatera*. In 1902 it was accepted as a full Genus, whose members were found from Cape Town, northwards throughout Africa, and thence eastwards through Persia and India to Ceylon. The type species of the genus was "*Gerbillus indicus*, Hardwicke."

The tail in all the African species (except in *nigricauda*, from British East Africa, which has a wholly black tail) is dark above and pale below, whereas in all the Asiatic forms the tail is dark above and below, and pale on the sides. Mr. W. R. Sherrin has recently called my attention to a skull character, viz., the shape of the parietal bone, which on examination proves to be quite as constant a distinguishing character as the tail pattern. I now therefore have no hesitation in separating the African forms as a distinct Genus, which I propose to call.

TATERONA, gen. nov.

Genotype *Taterona afra* (*Gerbillus afer*, Gray.)

The tail is dark above and pale below (except in *nigricauda*, where it is entirely black), whereas in restricted *Tatera*, it is dark above and below and pale at the sides.

The lateral sutures of the parietal, from the post-orbital process backwards, run horizontally for a certain distance, then turn vertically downwards for a greater or less distance; and again return sharply to the horizontal. In *Taterona* the length of the middle vertical part of the suture varies a little, but never exceeds one-third of the distance between the post-orbital process and the downward turn, while in *Tatera* it is approximately equal to this distance.

In *Taterona* the basi-sphenoid appears to taper forward to a point or narrow neck, owing apparently to the turning upwards of the lateral edges, almost to the vertical; in *Tatera*, in which these edges are less turned upwards the basi-sphenoid does not seem to taper.

Finally in *Taterona* the bridge over the ante-orbital foramen is relatively wider than in *Tatera* and the plate below the foramen formed by the flattening of the front edge of the orbit

terminates more abruptly at its outer end in *Taterona* than in *Tatera*, in which latter it is also usually broader. These last two characters however, though true in a very large number of cases, are not constantly reliable.

The Geographical ranges of *Tutera* and *Taterona* correspond with the continents of Asia and Africa respectively.

When I studied these Gerbils some years ago (A.M.N.H. 7, Vol. XVII, p. 474, 1906), the material available from India was so scanty that I was forced to content myself with recognising the two species *indica* and *cuvieri*. With the material now made available by the Survey, I have been encouraged to make a fresh examination of the forms contained in the Genus *Tatera* as restricted above.

The species of the Genus *Tatera*.

The Genotype and earliest species of *Tatera* to be described was *G. indicus* by Mr. Hardwicke in 1807. The type locality was given as "India." The type itself is in the National Collection, but faded almost beyond recognition and with its skull much damaged. In 1838 Mr. Waterhouse separated *cuvieri*, also giving the type locality as "India". This type is likewise in the National Collection, having been received from the Zoological Society so long as 60 years ago. A manuscript catalogue of that Society's Collection before it was dispersed, which has recently been found shows that the specimen was from Arcot, Madras. In 1843, Mr. Gray, in his List of Mammalia, published the name *G. hardwickei* without any description, but he placed under it as synonyms "*G. indicus*, Waterhouse and *Mus (Gerbillus) indicus*, Elliot." Waterhouse in describing his *cuvieri* compares certain of its characters with those of an animal which he calls "*Gerbillus indicus*, Hardwicke", these characters, however, are such that any determination of the exact animal referred to is impossible. Mr. Elliot, however, gives a very full description of the Dharwar *Tatera* (under the name *Gerbillus indicus*, Hardwicke) of which several specimens, unfortunately in very poor condition, contributed by Mr. Elliot himself, are in the National Collection. As Mr. Waterhouse recorded nothing which does not apply to this animal we are entitled, indeed constrained, to accept the Dharwar *Tatera* as the animal indicated under the name *hardwickei* by Mr. Gray and to consider Mr. Elliot's specimens as the co-types. Ten years ago (A.M.N.H. 7, Vol. XVII, p. 499, 1906) I named *T. ceylonica*, basing it on a single immature specimen very badly made up. The characters, I recorded, are, on more careful examination and comparison with Survey specimens, shown to be misleading. It is now clear that the type of *ceylonica* is really a young animal of the species of which very long series were obtained in Ceylon by Major Mayor. Next the series obtained by

Mr. Prater in Sind, proves to be quite distinct from any other found in India, resembling in its colouring as is not unnatural, the Persian species *tæniura*, *persica*, &c. Finally, some specimens collected by Col. Dunn, at Ambala, also require a name.

There are thus six species inhabiting India and Ceylon (but not Burma) which may be arranged in a key as follows :—

KEY.

- A Feet and tail short, only exceptionally exceeding 40 and 190 mm. respectively.
 - a General colour bright bay (Central India and Behar).
 - (1) *Tatera indica*, Hardwicke.
 - b General colour drab grey (Sind)
 - (2) *Tatera sherrini*, sp.n.
 - c General colour pinkish buff (Ambala, Punjab).
 - (3) *Tatera dunni*, sp.n.
- B Feet and tail longer, at least 44 and 200mm. respectively.
 - a Anterior palatal foramina very long (10mm.), general colour bay (South Maratha Country)
 - (4) *Tatera hardwickei*, Gray.
 - b Anterior palatal foramina short (6-7mm.).
 - aa General colour buffy (South Madras)
 - (5) *Tatera cuvieri*, Waterhouse.
 - bb General colour reddish (Ceylon)
 - (6) *Tatera ceylonica*, Wroughton.

(1) *Tatera indica*, Hardwicke.

Mr. Hardwicke describes this species as "bright bay, mixed with pencil-like strokes of dark brown longitudinally disposed." Unfortunately no really mature specimens were obtained by the Survey in Kumaon, from whence so many of Mr. Hardwicke's specimens were obtained, but I think there can be no doubt that the bright bay animal found throughout Behar, Khandesh, Central Provinces, Kathiawar and Palanpur belongs to this species. The dimensions given by Mr. Hardwicke (reduced to millimetres) are head and body 167; tail 175. The average of eight adult specimens from Behar and Khandesh is head and body 175; tail 190; hindfoot 40; and ear 24. The type skull is badly broken, but its greatest length is 46 mm. and from a skull of this length from Midnapur I record the following measurements, viz. :—Condyle-incisive length 41.5; zygomatic breadth 25; interorbital breadth 7; diastema 13; ear 20; anterior palatal foramina 8.5; posterior palatal foramina 2.5; and upper incisor tooth row 7.

So far as material is available it seems that the range of *indica* is Behar, the United Provinces, the Dekhan, and Gujerath.

(2) *Tatera sherrini*, sp. nov.

Size as in *indica*. Fur soft, silky, and fairly long (20-25 mm. on lower back). General colour above "ecru drab", below pure white. Face with usual pale markings before and behind the eyes. Feet white. Tail quadricolor, blackish above and below buff on the sides, tip (60-65 mm.) black, with lengthened hairs almost amounting to a tuft.

Skull smaller than in *indica*; the anterior palatal foramina short, the posterior exceptionally long; bullæ relatively large.

Dimensions of the type.—Head and body 162; tail 191; hind-foot 37; and ear 24.

Skull:—Greatest length 42; condylo-incisive length 37·5; zygomatic breadth 21; interorbital breadth 7; palatilar length 18·5; diastema 11·5; nasals 18; anterior palatal foramina 7; posterior palatal foramina 3·5; and molar tooth row 6.

Habitat.—Sind. Type from Jacobabad.

Type.—Old male. B. M. No. 15. 11. 1. 88. Original number 427. Collected by Mr. S. H. Prater on the 21st February 1915 and presented to the National Collection by the Bombay Natural History Society.

Altogether 22 specimens were obtained by the Survey. The contrast between the drab colouring of *sherrini* and the ochraceous of *indica*, or even the buff of *dunni*, is very marked, and in this *sherrini* seems to approach much more closely to *taeniura*, *persica*, &c., the Persian forms.

I have much pleasure in naming this very distinct species after Mr. W. R. Sherrin, of the Natural History Museum, who has given such invaluable assistance in organising the storage of the Survey material and in many other ways.

(3) *Tatera dunni*, sp. n.

A *Tatera* of the same size as *sherrini*, from which it is distinguishable by its pale buffy coloration.

Size as in *sherrini*. Fur soft and silky, but shorter than in that species (15-20 mm. on the lower back). General colour above "pinkish buff" below pure white. Otherwise as in *sherrini*.

Skull slightly longer and stouter than in *sherrini*, the anterior palatal foramina markedly longer.

Dimensions of the type.—Head and body 160; tail 190 (the Collector recorded it as 203, but it had obviously been distorted, the other specimens gave much smaller figures); hind-foot 37; ear 24. Skull:—Greatest length 44; condylo-incisive length

39; zygomatic breadth 22; interorbital breadth 7; palatilar length 20; diastema 12; nasals 19·5; anterior palatal foramina 8·5; posterior palatal foramina 2·5; upper molar tooth row, 6·5.

Habitat.—Ambala, Punjab.

Type.—Old male. B. M. No. 9. 4. 6. 10. Original number 254. Collected on 11th January 1909 and presented to the National Collection by Col. H. N. Dunn, R.A.M.C.

Eleven specimens are in the Collection. This species seems to me, judging by the skull, to be more related to *indica* than to *sherrini*, and it is possible that, when more material is available from Rajputana and the Punjab, it may be found to intergrade with the former.

(4) *Tatera hardwickei*, Gray.

As recorded above Mr. Gray based this name on Mr. Elliot's description of the Dharwar *Tatera*, which gave the colour as "uniform bright fawn" and the dimensions as:—Head and body 175; tail 202; hindfoot 50; ear 22·5 (these are converted measurements). These fairly correspond with those of the Survey material in the Dharwar, Kanara, and Koyna Valley Collections, except in the size of the hindfoot. I have never seen a *Tatera* with a hindfoot of 50 mm., so no doubt Mr. Elliot's measurement was taken differently from the method now employed, which gives an average of 44 mm. (max. 45). The skull is noticeable for its very long anterior palatal foramina. The following are the dimensions of the skull of an adult male from Dharwar, viz., Greatest length 48; condylo-incisive length 41·5; zygomatic breadth 25; interorbital breadth 7; palatilar length, 21; diastema 13; nasals 21; anterior palatal foramina 10; posterior palatal foramina 2·5; upper molar tooth row 7.

This species extends from Dharwar District southwards along the wooded belt on the West Coast to Travancore, and north along the Konkan and Ghats, at least as far as Ratnagiri. We have not sufficient material to dogmatise on its extension inland, but we know that in the north it gives way to *indica* in Ahmednagar, and in the south to *cuvieri* in Bellary and Mysore.

(5) *Tatera cuvieri*, Waterhouse.

"General colour very bright cinnamon yellow" is Mr. Waterhouse's description, and he gives the dimensions as:—Head and body 177; tail 200; hindfoot 44; ears 18. These correspond very fairly with those of specimens from Seringapatam, Vijayanagar, Trichinopoly, &c., except that the ear measurement quoted is evidently not the same as that now in use. The type skull is badly broken, but I gather that its greatest length was about 44 mm. From the skull of an old female from Seringapatam, I can record the following

measurements, viz., Greatest length 45; condylo-incisive length 39; zygomatic breadth 25; interorbital breadth 7; palatilar length 21; diastema 12; nasals 19; anterior palatal foramina 8; posterior palatal foramina 2; upper molar tooth row 7.

The range of *cuvieri* seems to be Bellary, Mysore and the whole country south of them, except the wooded Ghat strip on the West Coast.

(6) *Tatera ceylonica*, Wroughton.

I regret to say that in making these species I was misled by the condition of the solitary specimen, contributed by Mr. Kelaart. The fine series now available enables me to give a revised description of the species.

The general colour of the adult is very similar to that of *hardwickei* (not *cuvieri*, as would seem probable), but there is a somewhat larger admixture of black. The body dimensions are almost exactly those of *cuvieri*. The skull measurements of an adult female are as follows, viz., Greatest length 47; condylo-incisive length 40; zygomatic breadth 23.5; interorbital breadth 8; palatilar length 20; diastema 12; nasals 20; anterior palatal foramina 7; posterior palatal foramina 2; upper molar tooth row 6.5.

Tatera ceylonica seems to be spread all over the Island.

(B) THE SLENDER LORIS OF MALABAR.

By R. C. WROUGHTON.

When dealing with the Mysore Collection (Vol. XXII, p. 285, 1913) Miss Ryley explained that the name *gracilis* for the Ceylon Loris must give place to the much older *tardigradus*, and that these Mysore specimens must be known as *lydekkerianus*, Cabrera, being practically topotypes of that species. Later, on receipt of the Coorg Collection, not having specimens from Ceylon for comparison, she recorded them (Vol. XXII., p. 494, 1913) as *tardigradus*. Since then Major Mayor having obtained some specimens in the two Ceylon Collections (Nos. 13 and 18), I have now compared the three series of Loris and have come to the conclusion that the animals of Ceylon and Coorg belong to distinct species, and I propose to found a new species for the Malabar Loris under the name:—

Loris malabaricus, sp. n.

A Loris markedly smaller than either *tardigradus* or *lydekkerianus* with a strong russet tinge.

Size smaller than either *tardigradus* or *lydekkerianus*. General colour above "wood brown" darker on the nape and upper back, but without any sign of a dorsal median dark stripe as in the

Mysore Loris. Hairs of dorsal area tipped with silvery as in the other forms. Below buff, dull white in the other two species.

Dimensions as below:—

	<i>malabaricus.</i>	<i>tardigradus.</i>	<i>lydekkerianus,</i>
Head and body	216	245	260
Tail	7	...	...
Hindfoot	45	51.5	54
Ear	25	32	32
Skull:—			
Greatest length	48	55	55
Condyllo-basal length	41.5	46	47.5
Zygomatic breadth	29	34	35
Upper molar tooth row	13	14	15

The Collector records that the type of *malabaricus* had a tail 7 mm. long when taken. Probably all have a very short tail which is not appreciable in a skin.

Habitat.—Malabar. Type from Kutta, South Coorg.

Type.—A young adult female. B. M. No. 13. 8. 22. 3. Original number 2586. Collected by Mr. G. C. Shortridge, on the 21st February, 1913, and presented to the National Collection by the Bombay Natural History Society.

The Survey obtained altogether four specimens while another from Travancore in the British Museum Collection also belongs to this species.

(C) A NEW "LEAF MONKEY" FROM THE SHAN STATES.

BY R. C. WROUGHTON.

When writing the Shan States Report (J. B. N. H. S., Vol. XXII, p. 715, 1914) Miss Ryley recorded the local leaf monkey as *P. phayrei*. In the Mt. Popa Report when true *phayrei* had been received, I suggested (Vol. XXIII, pp. 464-465, 1915) that the Shan States animal might be *barbei*.

Three descriptions of *barbei* are available, viz.—Blyth's original description (J. A. S. B., xvi, p. 734, 1847), another in his Catalogue of the Mammalia in the Museum of the Asiatic Society (p. 14, 1863) and a third by Anderson (Ind. Mus. Cat., i, p. 48, 1911). Both Blyth and Anderson note that the shoulders and forelimbs are pale ("silvery", "greyish brown"), but neither of them notes the reflexion of the hair from a single central point on the forehead. I wrote to Dr. Annandale of the Indian Museum, Calcutta, who replied that the type of *barbei* "is an old specimen which has been mounted and exhibited for the last 70 years. There is an erect tuft on the top of the beast's head and no definite whorl of hair." He also sent me the head photographed and most kindly gave a reproduction which is here reproduced.



Head of the type of *Pithecus barbei*, Blyth.

This evidence seems to me conclusive that *barbei* belongs to the section of the langurs which have the hair laid straight back from the forehead over the crown. The Shan States langur has a distinct centre from which the hair radiates, on the forehead, and cannot therefore be *barbei*. I propose therefore to describe it as new under the name:—

Pithecus shunicus, sp. n.

A leaf monkey with the hair on the forehead radiating from a single central point; smaller than any other Indian species having this character; most nearly approaching (amongst them) *hypoleucos* in general colour, but wanting the black limbs of that species.

Size small. General colour above a slaty grey with a paler brownish tinge on the upper back; hind limbs and base of tail slightly

washed with silvery; a dull whitish collar extending across the nape between (and including) the whiskers. Upper and lower lips white. Hands and feet black. Below sparsely haired, greyish white.

Skull more spherical (less elongate) and much smaller than in the true langurs; frontal ridges obsolescent, the flattened area immediately above them, so marked in *entellus*, *schistaceus*, &c., entirely absent, with a consequently shortened muzzle.

Dimensions of type.—Head and body 590; tail 755; hindfoot 168; ear 33. Skull:—Greatest length 107; condylo-basal length 83; zygomatic breadth 79; breadth across orbits 65; palatal length 37; upper molar tooth row 28.

Habitat.—Northern Shan States. (Type from Hsipaw, alt. 1,400').

Type.—Adult male. B. M. No. 14. 7. 8. 5. Original number 3080. Collected by Mr. G. C. Shortridge, on the 26th May 1913, and presented to the National Collection by the Bombay Natural History Society.

In all 20 specimens obtained. Dr. Anderson in his *Anat. and Zool. Researches* records having seen troops of monkeys, which he surmised to be *P. barbei*, but which were almost certainly these species "in the Valley of the Tapeng, in the centre of the Kakhien hills" and again "in the defile of the Irrawaddy, above Mandalay, on the left bank of the river."

These species fall in Blanford's key, into Section A, on account of the whorl of hair on the forehead, this arrangement though convenient is quite artificial, for *shanicus* is in no way closely related to the true langurs, but, as already stated, to the leaf monkeys such as *obscurus*, &c.

(D) PARADOXURUS NIGER AND HERMAPHRODITUS OF BLANFORD.

By R. C. WROUGHTON.

Of the five species placed by Blanford in his key to the genus *Paradoxurus*, one he places in a section, "B," by itself. This species is now generally recognised as belonging to a distinct genus, *Paguma*, mainly on the characters used by Blanford. The two species *axrois* and *jerdoni*, from Ceylon and Malabar respectively, are such strongly marked forms that they too may be left out of consideration here. Thus there remain the two names *niger* and *hermaphroditus*, under which Blanford has ranged all the true toddy-cats.

On laying out all the available material for comparison, it at once becomes clear that we have not only two, but five forms, as follows, viz.:—(1) a northern peninsular form, (2) a southern peninsular form, (3) an Assam form, (4) a Burmese form, and finally (5) a northern Malay form, which extends into our limits, and runs through throughout Tenasserim.

The following is a list of the names given at various times to the Indian toddy-cats, viz. :—

- 1778. *V. hermaphrodita*, (Pallas), Schreb. Säug., iii., p. 426.
- 1820. *V. prehensilis*, *nigra* and *bondar*, Desm. Mamm., pp. 208, 210.
- 1821. *P. typus*, F. Cuv., Hist. Nat. Mamm., pl. 186.
- 1828. *P. leucopus*, Ogilb., Zool. Journ., iv., p. 300.
- 1832. *P. pallasi*, *pennanti*, *crossi*, and *hamiltoni*, Gray, P. Z. S., pp. 65-68.
- 1836. *P. hirsutus*, Hodgs., As. Res., xix., p. 72.
- 1837. *P. strictus*, and *quadriscriptus*, Horsf., A. M. N. H. (2), xvi., pp. 105, 106.
- 1841. *P. felinus*, Wag., Schreb. Säug., Supp. ii., p. 349.
- 1855. *P. quinquelineatus*, and *musangoides*, Gray, Ch. M. N. H., i., p. 579.
- 1864. *P. nigrifrons*, Gray, P. Z. S., p. 635.
- 1891. *P. nictitans*, Tayl., J. B. N. H. S., vi., p.
- 1910. *P. vicinus*, Schw., A. M. N. H. (8), vi., p. 230.
- 1914. *P. hermaphryditus rarus*, Mill. Sm. Misc. Colls., lxi., 21, p. 2.

The name *hermaphroditus* undoubtedly represents a *Paradoxurus*, but is specifically indeterminable, and was recognised as such by Desmarest so long ago as 1820. The habitat was given as "Barbarey". Of Desmarest's three names the first, *prehensilis*, is I believe not specifically recognisable, the habitat is said to be Bengal. It is stated to be based on a drawing from a sketch by (?) B. Hamilton. The second name, *niger*, answers the description of the southern toddy-cat. Its despatch alive to Paris from Pondicherry confirms this diagnosis. It is true that Desmarest adds: "On la dit originaire des Molluques," but I attach little importance to this, which was more than probably the vendor's attempt to enhance the value of his goods. The third name, *bondar*, is again based on a sketch from one of (?) B. Hamilton's drawings, also with the habitat "Bengal". I cannot place it at all certainly, and find it safest to accept it as a synonym of *niger*, of which also the *typus* of Cuvier is another, as are also *leucopus*, Ogilb., and *nictitans*, Taylor, these being albino examples from Orissa. Gray's names, *pallasi*, *pennanti*, *crossi* and *hamiltoni*, were all based on menagerie specimens and but for the fact that the types of *crossi* and *pallasi* are extant would all be indecipherable. These types show that *crossi* is the same species as *hirsutus*, Hodgson and *niger*, Desmarest. Horsfield's *strictus* and *quadriscriptus* represent the Assam form. Wagner's *felinus* and Gray's *nigrifrons*, *quinquelineatus*, and *musangoides*, based on animals in captivity, are all equally beyond recognition. Miller's *rarus* represents the Tenasserim form.

These five forms may now be arranged in a key, as follows, viz.:—

- A. Back and sides not or only obscurely striped and spotted.
(North India) ... *crossi*, Gray.
- B. Back and sides distinctly striped and spotted..
 - a. Smaller, hindfoot 75-80 mm., greatest length of skull 105-110 mm. Ground colour gray. (South India) ... *niger*, Desmarest.
 - b. Larger, hindfoot 80-90 mm., greatest length of skull 115-120 mm.
 - a¹ Ground colour fulvous. (Assam) ... *strictus*, Horsfield.
 - b¹ Ground colour dull or buffy white ...
 - a² Crown of head black (Upper Burma) ... *birmanicus*, Wroughton.
 - b² No black crown (North Malay) ... *ravus*, Miller.

Paradoxurus crossi, Gray.

1832. *Paradoxurus crossi*, Gray, P. Z. S., p. 66.

1836. *Paradoxurus hirsutus*, Hodgson, As. Res., xix., p. 72.

1864. *Paradoxurus nigrifrons*, Gray, P. Z. S., p. 635.

A *Paradoxurus* showing ordinarily a mere smear of blackish (often amounting to a dark mauve brown rather than to black) on a gray ground.

Hair fairly long but rather coarse. Rarely showing definite stripes on the back and never the usual spots on the flanks. Hodgson records it from the Nepal Terai, whence it occurs westwards through Rohilcund, the Deccan and Central India to Rajputana.

Paradoxurus niger, Desmarest.

1820. *Felis niger*, Desmarest, Mamm., p. 208.

1826. *Felis bondar*, Desmarest, l. c., p. 210.

1821. *Paradoxurus typus*, F. Cuvier, Hist. Nat. Mamm., pl. 186.

1823. *Paradoxurus leucopus*, Ogilby, Zool. Journ., iv., p. 300 (allino).

1832. *Paradoxurus palliar*, Gray, P. Z. S., p. 66.

1851. *Paradoxurus westermanni*, Taylor, J. B. N. H. S., vi., p. 2.

A smaller animal than the preceding and either of the following. Its stripes and spots were heavily marked in deep black on a gray ground. The type was from Pondicherry; its range however from

Orissa on the east to Ceylon in the south and the Southern Mahra-tha Country in the north.

Paradoxurus strictus, Horsfield.

1837. *Paradoxurus strictus*, Horsfield, A. M. N. H. (2), xvi., p. 105.

1837. *Paradoxurus quadriscipus*, Horsfield, l. c., p. 106.

1910. *Paradoxurus vicinus*, Schwarz, A. M. N. H. (8), vi., p. 230.

A larger animal, about the size of *crossi*. Fur long and soft, the stripes and spots marked in black on a fulvous ground. Hodgson records it from the central region of Nepal, whence it ranges eastward through Darjiling, Bhutan Duars, and Assam. Schwarz's *vicinus* is a very brightly coloured specimen, with smaller measurements, but it is quite a young animal.

Paradoxurus birmanicus, sp. n.

A *Paradoxurus* of fully average size, with distinct black stripes and spots on a very pale, almost white, ground.

Size as in *strictus* and *crossi*. Fur shorter and coarser than in *strictus*. Head black, with the usual white blaze across the face between the eyes and the ears. General colour above a dull white or very pale buffy grey, with the usual three median dorsal stripes, and with scattered spots arranged more or less in lines parallel to the stripes.

Skull as in *crossi*, &c., but lighter and somewhat smaller.

Dimensions of the type:—Head and body, 570; tail, 510; hind-foot, 85; ear, 48.

Skull:—Greatest length, 110; condylo-basal length, 109; zygomatic breadth, 60; palatilar length, 49; nasals, 25; back of m¹ to front of p³, 19.

Habitat:—Burma. Type from Mingun, near Sagaing, Upper Burma.

Type:—Old female. B. M. No. 14. 7. 19. 89. Original number, 3261. Collected by Mr. G. C. Shortridge on 10th July 1913. Presented to the National Collection by the Bombay Natural History Society.

This species seem to extend throughout Burma, including the Shan States, till it meets the intruding North Malay toddy-cat (*P. rarus*) in Tenasserim. It would seem also to extend eastwards into Siam. Schwarz's *cochinensis* from Camboja, and Kloss's *lutensis* seem both to be of this type, though both are much smaller.

Paradoxurus rarus, Mill.

1914. *Paradoxurus rarus*, Miller, Sm. Mix., Colls., lxi., 21, p. 2.

Very similar to *birmanicus*, but easily recognisable by the absence of the black on the crown. The type locality is Trong, S. W. Siam, but it undoubtedly ranges through Tenasserim, and probably into South Pegu.

THE PALMS OF BRITISH INDIA AND CEYLON, INDIGENOUS AND INTRODUCED.

BY

E. BLATTER, S.J..

PART XVIII.

(With Plates XCVI to XCIX and 3 text figures.)

(Continued from page 688 of Volume XXIV.)

IV.—LEPIDOCARYINÆ.

Spadix branched once or more in a 2-ranked arrangement; flowers in concinni or 2-ranked spikes with bracts and bracteoles round them, carpels 3, fast united, covered with scales; fruit 1-seeded, covered with hard scales; feather or fan leaves, reduplicate.

4.—*Mauritiææ*.

Leaves fan-shaped with regularly or irregularly divided, slightly reduplicate segments. Flowers dioecious 1, dimorphic.

DISTRIBUTION.—Tropical America, east of the Andes between 16° S. L. and 12° N. L.

Mauritia L., *Lepidocaryum*, Mart. Not represented in India.

5.—*Metroxyleæ*.

Leaves paripinnate with regularly divided spinous pinnae.

Flowers polygamous-hermaphrodite or diclinous.

DISTRIBUTION.—The moist tropics of the Old World.

Sub-tribe: *RAPHIÆÆ*.

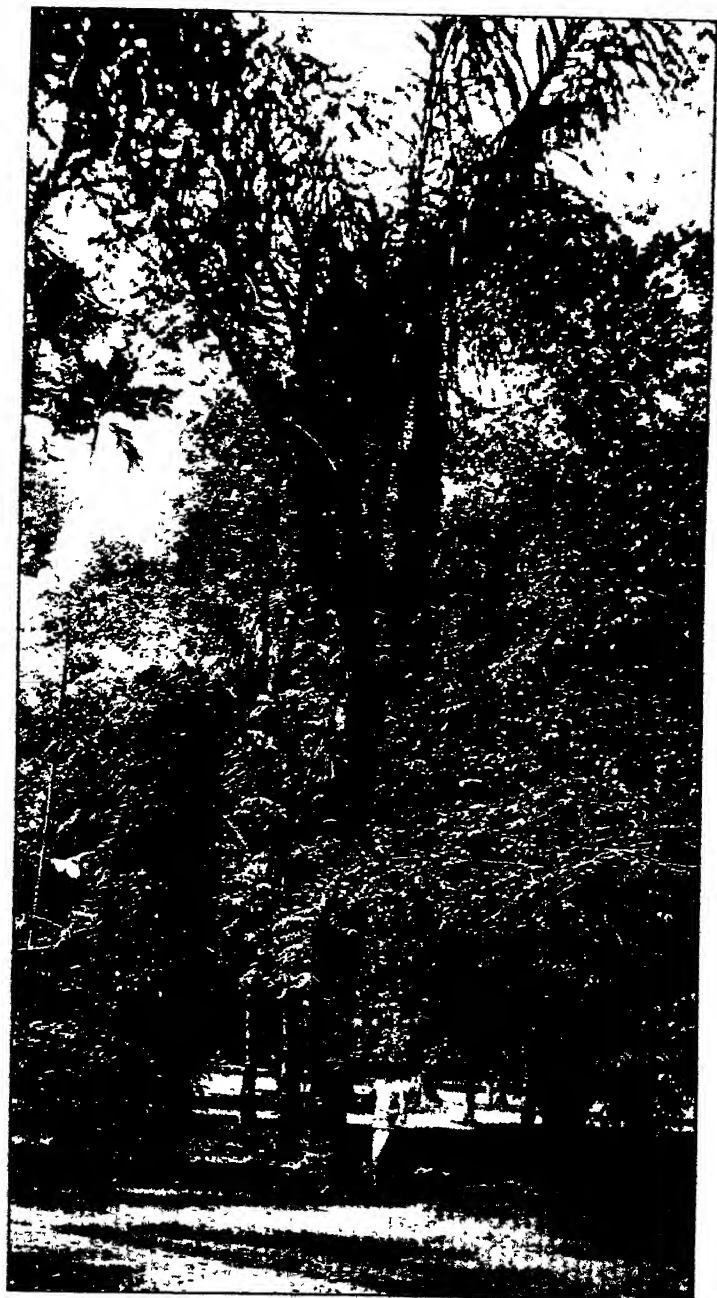
Flowers polygamous-hermaphrodite, or male and female flowers on the same branches of the inflorescence. Ovary completely 3-locular. Embryo horizontal.

DISTRIBUTION.—Africa on the coast of Guinea and inland to the sources of the Nile, also in East Africa on the coast of Zanzibar and perhaps in Western Madagascar.

RAPHIA, P. de B., *Oncocalamus*, Wendl. & Mann, *Ancistrophyllum*, Hook., *Eremospatha*, Wendl. & Mann.

RAPHIA, Beauv. Fl. Owar. I. 75, t. 44, fig. 1, 45, 46.

Lam. Illustr. t. 771.—Gaertn. Fruct. t. 40, f. 1.—Sprngl. Gen. Pl. 283 (*Metroxyleæ*).—Mart. Hist. Nat. Palm. II, 53, t. 45, 47, fig. 5, 48 (*Sagrus*).—III, 316, 345.—Kth. Baum. Pl. III, 216.—Meisn. Gen. Pl. 265.—Griff. Palm. British India, t. 182.—Wallace Palm. Amaz. 42, t. 2, 16.—Mann & Wendl. Trans. Linn. Soc. 24, 437, t. 30, 42.—Oerst. Palm. Centroam. 1858. Pp. 116 in Fl. Bras. III, II, 286, t. 61, 62.—Benth. & Hook. Gen. Pl. III, 237, 116.—Lam. Bot. II, 237.—Becc. in Webb. III (1910), 37—



Raphia Ruffia, Mart.

Large trees; stem short, stout, annulated. Leaves gigantic, regular, pinnate; leaflets linear with the midribs and edges spinulose; bases of the petioles sheathing, persistent some way down the stem, the margins fibrous.

Spadices growing from among the leaves about $3\frac{1}{2}$ feet long, much branched. No common spathe, but many small, incomplete sheaths. Flowers monocious, reddish-brown or greenish, male and female in separate bracts of the same branch. Male flowers: calyx campanulate, truncate; corolla triphyllous; stamens 6—8. Female flowers: calyx 3-dentate, corolla campanulate-infundibuliform, 3-partite half-way down. Ovary 3-locular; stigmas 3, sessile.

Berry with large imbricated scales, unilocular and 1-seeded by abortion. Seed cylindric oval, elongate-erect; embryo horizontal in the middle; albumen ruminant.

Species about 20.—Tropical Africa and America.

RAPHIA RUFFIA, Mart. Hist. Nat. Palm. III, 217; Kunth. Enum. Pl. III, 217; Wright in Th. Dyer. Fl. trop. Afr. VIII, 104 (partim); Drude in Engler Nat. Pflanzenf. I, 46, f. 36; Becc. in Agricolt. colon. IV. (1910), t. I; Webbia III (1910), 47.—*R. pedunculata* P. Beauv. in Desv. Journ. Bot. II, 87, et in Fl. d'Oware et de Benin, I, 78, t. 44, f. 2, et t. 46, f. 2.—*R. lyciosa* et *R. polymita* Comm. ex Kunth, Enum. Pl. III, 217.—*R. tamaricensis* Sadebeck in Engl. Bot. Jahrbücher, XXXVI (1905), 354.—*R. vinifera*, Drude (non Palis. de Beauv.) in Mart. Fl. Bras. v. III. pt. II, tantum in tab. 62, f. I. D.—*R. nicaraguensis* Oersted in Vidensk. Meddel. naturhist. Forening, Kjöbenh. 1858 (1859) 52.—*R. vinifera* var. *nicaraguensis* Drude in Fl. Bras. l. c.—*Sagus farinifera*, Gaertn. Fruct. et Sem. II, t. 120, f. 3.—*Sagus Ruffia* Jacq. Fragm. 7; No. 27, t. 4, f. 2.—*Sagus pedunculata* Lam. Encycl. Suppl. V, 13, et Illustr. III, 357, t. 771, f. 2, a-g.—*Sagus laevis*, Griff. Palms Br. Ind., tantum in tab. CLXXXII.—*Metroxylon Ruffia* Spreng. Syst. II, 139.*

NAMES OF THE TREE.

English: Raffia, raffia palm, rafia palm, raphia palm, roffia, roffia palm.

French: Mouffia, palmier de Mayotte, raffia, rafia, raphia.

German: Bambuspalm, Madagaskarische Sagopalme, Raffiabastpalme, Raffiaweinpalme.

Dutch: Madagascarsche sagoboom, sagodragende palm.

NAMES OF THE FIBRE.

In Madagascar: Rafia.

English: Raffia, rafia fibre.

French: Raffia.

German: Bambuspalmenfaser, Raffia, Raffiafaser, Raphiastroh.

Dutch: Raffia, raffiabast, raffiabindbast, rafiavezel, raphia.

DESCRIPTION.—Stem up to 30 feet high and often (in very strong specimens) $3\frac{1}{2}$ feet in diameter, ringed. Leaves rising straight

* Synonymy ex Becc. l. c.

up, reaching 50 feet in length. Petiole very stout, relatively short, abruptly dilated at the base into a short and broad sheath surrounding the stem, deeply excavated on the upper side, convex on the lower; margins very acute, armed with short pale ascending spines, similar to those at the base of the segments. Segments very numerous, biseriate and more or less distinctly geminate on both sides of the rhachis, broadly linear, very slightly restricted towards the base, long-acuminate, very thinly coriaceous, rigid for the greater part of their length, green and shining above, whitish-pulverulent below. The segments vary as to length and breadth on the same leaf according to their position: the lowest are very acuminate; as long as the middle ones, but narrower, about $\frac{4}{5}$ inch broad, and more spinous than these. The central segments are distinctly geminate, the bigger ones 4-4 $\frac{1}{2}$ feet long, sometimes up to 6 feet, and 1 $\frac{1}{2}$ -1 $\frac{3}{4}$ inch broad, spinulose on the margins, more or less spinulose on the median rib, or also entirely unarmed. The segments near the apex become gradually smaller as to length and breadth, less distinctly geminate and entirely unarmed.

Spadix very large, rising successively from the axils of the highest leaves, first erect, then recurved and turned downwards; the same plant bears several spadices at the same time and of different age; they vary in length from 7-11 feet. Spadix cylindric, about 8 inches thick at the time of flowering; peduncle stout, recurved, slightly compressed, about 5 inches broad, sheathed below by 2 coriaceous, about 3 $\frac{1}{2}$ feet long, spathes; the outer spathe acutely bicarinate; then follow other empty spathes which surround the peduncular part; and finally there are many others of which each bears in its axil a partial inflorescence. Partial inflorescences compressed, short and broad, 6-8 inches long, cuneate at the base, getting gradually broader towards the apex, divided into branches or floriferous spikelets of unequal length. Each partial inflorescence arises from the axil of a primary spathe which is rather broader than long and which terminates abruptly in an acuminate apex, being, on the whole, longer than the corresponding inflorescence. Primary spathes thinly coriaceous, of chestnut colour inside, hazel outside. Each inflorescence has a very short peduncular part which is strongly compressed, $\frac{1}{2}$ -1 $\frac{1}{2}$ inch long, $\frac{3}{4}$ - $\frac{1}{2}$ inch broad, and sheathed by a short secondary spathe; this is narrowly sheathing, narrowly 2-winged, prolonged at the apex to the right and left into a very acuminate subfalcate and acutely carinate apex; the tertiary spathes, from the axils of which rise the spikelets, are close to each other, very shortly infundibuliform truncate at the apex, entire, non-ciliate, with a thin margin. Spikelets bearing perfectly bifarious flowers, vermiform, strongly compressed, slightly sinuose, about 1 inch broad at the base, getting very slightly thinner towards

the apex; the lowest ones are larger and measure 3-6 inches in length; the upper ones getting gradually shorter. Female flowers; ovate, acute $\frac{1}{2}$ inch long; involucrellum membranaceous, yellow, forming a cupule almost complete or more or less split on the back, narrowly embracing the calyx. Calyx tubular-urceolate, truncate, entire and slightly narrowing at the mouth from which rise the conical apex of the ovary and the stigmas, which form a pyramidal trigonous, acute point. Corolla invisible externally, being entirely

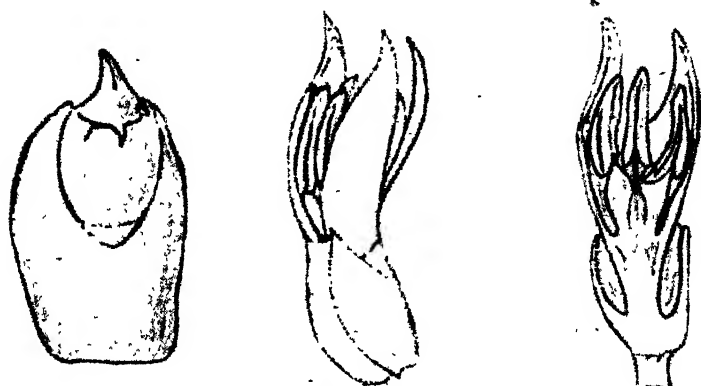


FIG. 1.—*Raphia ruffia*, Mart. Left: Female flower without spathe, seen from the axile side. Middle: Male flower. Right: Median section of male flower. (After Beccari.)

included in, and slightly shorter than, the calyx, divided into 3 large, broadly triangular, acuminate lobes. Staminodes forming a membranous cupule which is irregularly sinuous—6-dentate, the teeth being more or less triangular. Ovary ovate, stigmas 3, triangular, acute, connivent. Male flowers perfectly distichous and uniseriate, $\frac{3}{8}$ inch long and $\frac{1}{16}$ inch broad. Spathe of male flower slightly longer than the calyx of its own flower, acutely bicarinate, shortly bidentate at the apex (fig. 1). Calyx tubular-cyathiform, superficially and obtusely 3-denticulate, slightly shorter than the corresponding spathe. Stamens normally 6, sometimes 7-8, equal; filaments stout, clavate-fusiform, abruptly contracted at the connective, connate at the base; anthers linear, sagittate-auriculate below, obtuse. Corolla about twice as long as the calyx, subterete, divided to its lower fourth into 3 linear-lanceolate, thinly coriaceous segments.

Fruits variable in shape and size, 1-2 inches long, $1\frac{1}{2}$ - $1\frac{3}{4}$ inch broad, more or less turbinate, or globose-ovate, and slightly longer than broad, or subglobose, always slightly depressed at the apex and terminated by a very short conical top, more or less attenuate below into an acute and symmetrical base, more rarely, truncate at the base. Scales disposed on 12-13 orthostichies, of chestnut or

mahogany red colour, shining, strongly convex, deeply sulcate longitudinally, margin very narrow, scarious, blackish, fimbriate-ciliate, prolonged into an obtuse apex. Pericarp on the whole $\frac{1}{2}$ - $\frac{1}{4}$ inch thick. Seed obovate, rotundate at the apex, more or less attenuate and acute below, sometimes $\frac{1}{4}$ - $\frac{1}{2}$ inch thick, and still thicker at the base; albumen very hard, osseous, white and penetrated by intrusions of the integument which render it more or less ruminant. Embryo situated on one side, a little below the middle.

HABITAT.—Indigenous in Madagascar. Extensively cultivated on the Mascarene Islands. Naturalized in America.

ILLUSTRATION.—The specimen of *Raphia ruffia* shown on plate XCVI grows in the Botanic Gardens of Peradeniya. In the centre of the crown a fruiting spadix is visible. The palm was photographed by Mr. Macmillan.

RAPHIA VINIFERA, Palis. de Beauv. in Desvaux, Journ. de Bot. II, (1809) 87, et Fl. d'Oware et de Benin, I, 77, t. 44, f. 1, 45 (exc. syn. Gaertn.) et tab. 46, f. 1. a. b. c. d.; Martius Hist. Nat. Palm. III, 217 (ed. I); Beccari in Webbia III (1910) 88.—*Sagus vinifera* Lam. Encycl., Suppl. V, 13 (?)—*Sagus Ruffia* var. β Willd. Sp. pl. IV, 404.—*Metroxylon viniferum* Spreng. Syst. veg. II, 139, n. 2.

NAMES OF THE TREE.

English : Bamboo palm, Jupati palm, Pharaoh's date-palm, wine palm.

French : Bourdon, palmier à vin, raphier.

German : Bambuspalme, Echte Weingpalme, Weingebende Sago-palme, Weinpalme.

Dutch : Raphiavesselpalm.

NAMES OF THE JUICE.

English : Palm wine, toddy.

French : Vin de palme.

German : Palmwein.

Dutch : Palmwijn.

NAMES OF THE FIBRE.

English : African bass, African bass fibre, Lagos bass, Lagos raffia, West African bass, West African bass fibre, West African piassava, West African raffia.

Dutch : West-Afrikaansche raffia.

Of the fibre from the young unopened leaves.

English : Raphia grass.

DESCRIPTION.—Stem comparatively short. Leaves rising nearly vertically from the stem, bending out on every side in graceful curves, forming a magnificent plume. Spadices very large, compoundly branched and drooping, grow in grove between the leaves and having numerous bract-like sheaths. Partial inflorescence on



WINE PALM (*Raphia vinifera*, Palis. de Beauv.).

the whole ovate, strongly compressed, with the spikelets densely arranged and distichous, about $\frac{5}{8}$ foot long comprising the peduncular part which measures about 3 inches and which is sheathed by some tubular spathes, of which the outermost is bi-winged and prolonged on both sides into a falciforme acuminate apex. The general spathe of the partial inflorescence is much dilated at the base and ends in a broad and rather long acuminate point, is opaque and hazel outside; shining and chestnut inside. Spikelets slightly arcuate, much compressed, of pectiform appearance on account of the regular arrangement of the flowers; the bigger ones situated on the lower third are $3\frac{1}{2}$ – $3\frac{3}{4}$ inches long; the upper ones become gradually shorter, about $\frac{1}{2}$ inch thick comprising the flowers; the spathellules are distinctly and densely ciliate-paleaceous on the margins. The flowers seem to be perfectly distichous. Male flowers (fig. 2): small, when fully developed $\frac{1}{3}$ inch long, curved calyx cyathiform, superficially 3-denticulate and ciliate-paleaceous on the margin, corolla about $2\frac{1}{2}$ times longer than the calyx, opaque on the outside, divided almost to the base into 3 linear segments. Stamens 9; filaments stout, subfusiform, free or more or less united at the base of the corolla. Female flowers (fig. 2): about $\frac{2}{3}$ inch long and $\frac{1}{4}$ inch broad, acuminate, slightly attenuate at the base.

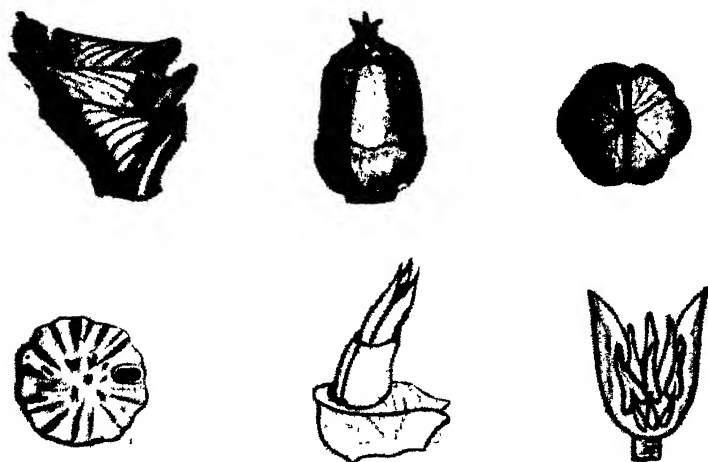


FIG. 2.—*Raphia vinifera*, P. D. B.

Upper row—Left: Two female flowers.

Middle: Single female flower.

Right: Seed seen from below.

Lower row—Left: Transverse section of seed with embryo.

Middle: Male flower with bract and bracteole.

Right: Male flower opened (after Drude).

Calyx not very deeply 3-lobed; lobes obtuse, ciliate-paleaceous on the margin, especially at the apex. Corolla by about $\frac{1}{2}$ longer

than the calyx, divided half way down into 3 triangular elongate and acuminate segments. Staminodes united into a ring and connate with the corolla tube for the lower third of the latter, divided in the free part into 6 large triangular elongate and subulate teeth. Ovary pyramidal-trigonus; stigmas convergent.

Fruits cylindrical-ellipsoidal, equally broad below and above.

HABITAT.—Lower Nigeria.

USES.—A pleasant wine is obtained from *Raphia vinifera*. It is procured by cutting out the terminal inflorescence as soon as it makes its appearance; the wine is then procured in large quantities.

The petioles of the leaves are employed as poles upon which to carry palanquins. The leaflets are used for roofing.

ILLUSTRATION.—Mr. Macmillan was kind enough to take a photograph of a fine specimen of *Raphia vinifera* growing in the Botanic Gardens of Peradeniya. There arise from between the leaves about 6 flowering and fruiting spadices at different stages of development. (Plate XCVII.)

Sub-tribe: CALAMEÆ.

Flowers polygamous-monœcious, diclinous-monœcious or diœcious. Ovary incompletely 3-locular.

DISTRIBUTION.—Scarcely touching tropical West Africa, the Calameæ begin with a great number of species on the tropical slopes of the Himalaya, pass through continental India to the Sunda and Malay Archipelago and finally to Polynesia on the one hand, and the tropical coast of Australia on the other.

Euglossonia, Griff., *Metroxylon*, Rottb., *Pigafetta*, Bl., *Zalacca*, Reinw., *Korihalsia*, Bl., *Ceratolobus*, Bl., *Plectocomia*, Mart, *Plectocomiopsis*, Becc., *Calamus*, L., *Daemonorhops*, Bl.

KEY TO THE GENERA DESCRIBED BELOW.

A. Monocarpic palms, flowering once and then dying.

I. Spadices axillary from the uppermost leaves.

1. Stem scandent. Spadix with long amentiform branches clothed with large closely imbricating inflated spathelets that conceal the spikelets of flowers 4. *Plectocomia*.

2. Stem scandent. Spadix much branched, the branches having small infundibular spathelets, each containing a small spikelet. Scales of fruit distinct 5. *Plectocomiopsis*.

II. Spadix very large, terminal 1. *Metroxylon*.

B. Polycarpic palms, flowering annually.

a. Leaflets acuminate, quite entire, nerves parallel.

1. Stem elongate, spathes tubular, persistent 6. *Calamus*.
2. Stem elongate; spathes cymbiform or open, deciduous..... 7. *Daemonorhops*.
3. Stem short or absent; spathes many, persistent 2. *Zalacca*.

b. Leaflets rhomboid cuneate or oblanceolate, toothed; nerves flabellate.....

3. *Korthalsia*.

METROXYLON, Rottb., Nye Samml. Dansk. Selsk. Skrift. II, 525, t. 1 (from the Greek "metra," the heart of a tree, and "xylon," wood; in allusion to the large proportion of pith contained in the plant).

Mart. Hist. Nat. Palm. III, 213, 343, t. 102, 159.—Griff. Palm. Brit. Ind. 21, t. 181, append. XX.—Becc. Males. I, 91.—Benth. & Hook. Gen. Pl. III, II, 935, 109.

Stem erect, short, stoloniferous, in the lower part irregularly annulate, in the upper closed with the bases of fallen leaves. Leaves terminal, large, almost erect, pinnate; segments linear-lanceolate, acuminate, reduplicate, the edges and central vein often setose; petioles and sheaths often armed with long spines.

Spadices large, lasting for several years, lateral, decompound-distichously branched; spathes tubular, coriaceous. Flowers polygamous-monoecious on amentaceous branches. Calyx semi-trifid or tri-dentate; corolla tripartite. Male flowers: stamens 6, filaments united at the base with the corolla; anthers dorsifixed, subsagittate; pistillode consisting of more or less distinct carpels. Female flowers: incompletely trilocular; ovules erect, anatropous; styles and stigmas forming a pyramid; staminodes forming a six-dentate urceolus, barren anthers small or absent.

Berry with dry flesh, imbricate with retrorse scales, unilocular and 1-seeded by abortion; albumen deeply excavated or ruminant. Embryo dorsal. Species about 7.—Indian floral region.

USES.—*Metroxylon* furnishes the best sago. In order to procure it the trunk is split into logs a few feet long, their soft interior extracted, pounded, and thrown into water; the water is then drained off from the pulpy mass, when the starch comes away with it, and upon being allowed to settle is afterwards prepared and purified by successive washings. A tree fifteen years of age will yield from 600-800 pounds. The sago-meal, as it is called, is the form in which this starch is procured, although it is not commonly imported to Europe in this state. The usual form in which it is brought to the market is called Pear Sago. We follow Bennett in

the description of the process by which this sago is prepared. The raw sago is a mass of rather soft consistence and of a dirty white colour, being mingled with several impurities. It first undergoes several different washings through cloth strainers. When the raw material is sufficiently clean, the masses at the bottom of the vessels are collected, broken into pieces, and placed upon platforms in the sun to dry, being broken into still smaller pieces as the drying proceeds. As soon as the pieces are sufficiently dry, they are pounded and sifted upon long benches through sieves made of the midrib of the leaves of the Coco-nut Palm, and placed at certain distances in a longitudinal direction, so as to cause the pulverized, or rather broken, masses of sago to pass through it of the size required. Having been passed through the sieve, a certain quantity at a time is taken, placed in a large cloth, tied to cross sticks, in the form of a bag, hanging by a cord from the roof of the building; the bag is then shaken forwards and backwards and the sago-powder itself must be occasionally shaken. This is continued for about ten minutes, when it is turned out granulated. It is then placed in small wooden hand-tubs, looking beautifully and delicately white, but still so soft as to break instantly with the slightest pressure under the fingers. It has then to undergo the drying process in large iron pans over a fire, where it is constantly stirred about with a wooden instrument. After this it is resifted at another bench and rebaked, when it is considered prepared. It is then of a fine pure white colour, and, being spread thinly over a long and large bin, in course of time becomes both harder and of a darker colour. The sago is collected just before the tree begins to show its large terminal flower spike. This generally occurs at the age of seven or eight years. When the flower and fruit are allowed to develop, which is in two years from the first appearance, the pith of the centre is found dried up, the leaves have fallen, and the tree perishes.

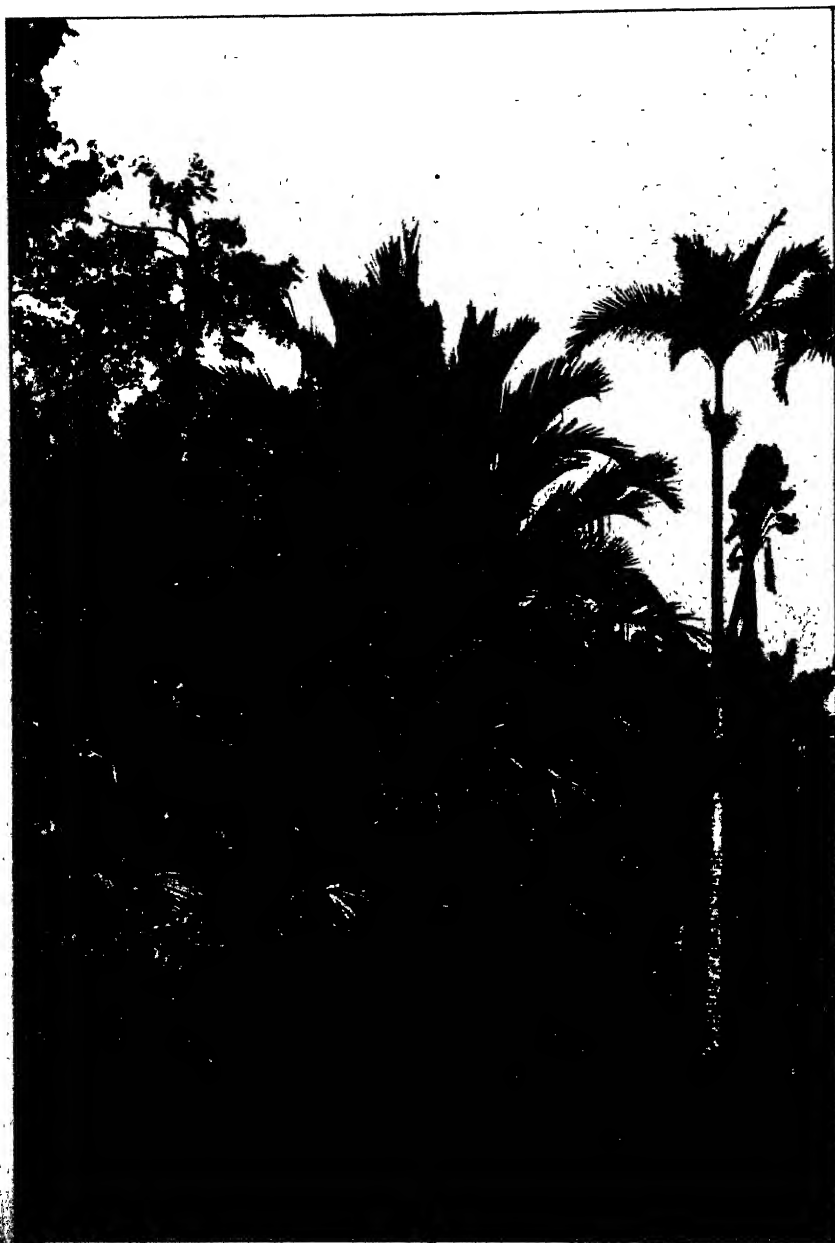
METROXYLON SAGUS, Rottb. in Nye Saml. K. Dansk. Vid. Skrift. II, 527; Miq. Fl. Ind. Bat. III, 147; Becc. in Nuov. Giorn. Bot. Ital. III, 29.—*M. inermis* Mart. Hist. Nat. Palm, III, 215.—*Sagus levis*, Rumph. Herb. Amb. I, 76; Blume Rumphia II, 147, t. 86; Griff. in Calc. Journ. Nat. Hist. v. 20; Palms Brit. Ind. 94 (not t. 182).—*S. Rumphii* Blume l. c. t. 126, 227.—? *S. Koenigi* Griff. l. c. 19, 22, t. 181.—*S. inermis* Roxb. Fl. Ind. III, 623.

NAMES.

English: Common sago palm, Rumphius's sago palm, sago palm, sago tree.

French: Arbre au sagon, palmier du Japon, palmier sagon, sagonier, sagonier farineux, sagoutier.

German: Echte Sagopalme, Molukische Zapfenpalme, Rumph's Sagopalme, Sagobaum, Sagopalme.



SAGO PALM (*Metroxylon Sagus*, Rothb.).



RUMPH'S SAGO PALM (*Metroxylon Rumphii*, Mart.).

Dutch : Meelboom, meelgevende palmboom, moluksche palmboom, sagoboom, sagoebloom, sagopalm.

NAMES OF THE FLOUR.

English : Sago, sago flour.

French : Farine de sagon.

German : Ostindische Graupen, Ostindische Tapiocca, Ostindischer Sago, Palmenstärke, Sago, Sagostärke.

Dutch : Bloem van sago, oostindische sago, palmensago, sagoë, sago sagoemeel, sagemel.

DESCRIPTION.—Stem about 20 feet high, with many basal offshoots, as stout as that of the coconut-palm, annulate, covered above with the bases of fallen leaves. Leaves resembling those of the coconut, but more erect, unarmed; segments linear, acute, keeled, smooth. Inflorescence developing when the tree is about 20 years old.

Spadices several, terminal, alternately branched; spikes 5-8 inches long. Spathes unarmed. Flowers minute, sunk in rusty wool, scarcely larger than a grain of mustard seed, bisexual.

Fruit globose, size of a small apple; scales shining, channelled (Jack). The fruit takes 3 years to ripe.

HABITAT.—Malacca, Malay Islands.

ILLUSTRATION.—We have to thank Mrs. Burkill for kindly taking the photograph (reproduced on pl. XCVIII) in the Botanic Garden of Singapore.

METROXYLON RUMPHII, Mart. Hist. Nat. Palm. III, 213, 313, t. 102, 159; Miq. Fl. Ind. Bat. III, 140; Becc. in Nuov. Jor. Bot. Ital. III, 30; Malesia I, 91; Becc. and Hook. f. Fl. Brit. Ind. VI, II, 481.—*Sagus Rumphii*, Willd. Sp. Pl. IV, 404; Roxb. Fl. Ind. III, 623.—*S. genuina* Blume Rumphia II, 150.—*S. farinifera*, Gaertn. II, 186, t. 120, f. 3; Rumph. Herb. Amb. I, 75, t. 17, 18.

NAMES.—Rumph's Sago-Palm; Sagu (Malay). See also the names mentioned under foregoing species.

DESCRIPTION.—Stem 25-30 feet high, soboliferous. Leaves 20 feet long and more; leaflets linear-lanceolate, acuminate, 2-4 feet long, 1—several inches broad, on the edges and central nerve setose; sheath coriaceous, 3 feet long; petiole densely covered with spines which are $\frac{1}{2}$ -1 $\frac{1}{2}$ inches long. Spadix 12-15 feet long, the secondary branches 18-12 inches long; spathes of the first and second order coriaceous tubular, obliquely truncate, armed with compressed, blackish spines. The catkin-like spikes cylindric, 2 $\frac{1}{2}$ inches long of the size of the little finger, densely compact with bracts and bracteoles; bracts suborbicular or transversely elliptic, 1 $\frac{1}{2}$ lines long, coriaceous-membranous; bracteoles 1 line long, campanulate, compressed. Calyx campanulate, trifid; sepals ovate,

acute, longitudinally nervose, corolla trifid below the middle; petal oblong-ovate. Male flowers (fig. 3): Stamens 6, as long as the

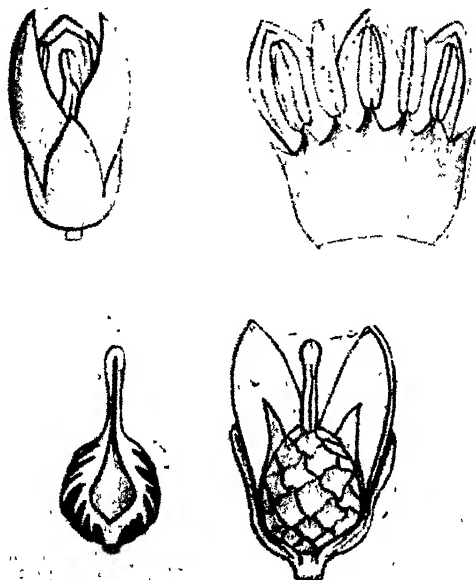


FIG. 3.—*Metroxylon Bumphii*, Mart.

Upper left: Male flower.

right: Corolla of male flower opened.

Lower left: Longitudinal section of pistillode of male flower.

right: Part of female flower showing the fertile ovary and two staminodes. (after Martius).

corolla; filaments united into a subcylindric tube, attached to the base of the corolla, subulate; anthers linear, dorsifixed; pistillode slightly shorter than the corolla; styles and stigmas 3. Female flowers (fig. 3): Staminodes forming a membranous, 6-fid urceolus, united with the corolla. Berry depressed-globose, $1\frac{1}{2}$ inches in diameter, crowned with the style, with imbricate scales. Scales rhomboid, convex, with a median vertical furrow, the edges ciliate. Flesh spongy, dry. Seed globose, rugulose.

HABITAT.—Malay Archipelago.

ILLUSTRATION.—Mr Macmillan has supplied us with the photograph of Bumph's Sago Palm which grows in the Botanic Garden of Peradenya. There are two specimens visible on Pl. XCIX, both without either flower or fruit.

(To be continued.)

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON.

REPORT No. 27. BHUTAN DUARS.

By R. C. WROUGHTON.

COLLECTION	...	...	No. 27.
LOCALITY	...	...	Bhutan Duars.
DATE	...	...	October, 1915; May, 1916.
COLLECTED BY	...	...	N. A. Baptista.
EARLIER REPORTS	...	...	No. 1. East Khandesh, Vol. XXI, p. 392, 1912; No. 2. Berars, Vol. XXI, p. 820, 1912; No. 3. Cutch, Vol. XXI, p. 826, 1912; No. 4. Nimar, Vol. XXI, p. 844, 1912; No. 5. Dharwar, Vol. XXI, p. 1170, 1912; No. 6. Kanara, Vol. XXII, p. 29, 1913; No. 7. Central Provinces, Vol. XXII, p. 45, 1913; No. 8. Bellary, Vol. XXII, p. 58, 1913; No. 9. Mysore, Vol. XXII, p. 283, 1913; No. 10. Kathiawar, Vol. XXII, p. 464, 1913; No. 11. Coorg, Vol. XXII, p. 486, 1913; No. 12. Palampur, Vol. XXII, p. 684, 1914; No. 13. S. Ceylon, Vol. XXII, p. 700, 1914; No. 14. Shan States, Vol. XXII, p. 710, 1914; No. 15. Kumaon, Vol. XXIII, p. 282, 1914; No. 16. Dry Zone, Central Burma & Mt. Popa, Vol. XXIII, p. 460, 1915; No. 17. Tenasserim, Vol. XXIII, p. 695, 1915; No. 18. Ceylon, Vol. XXIV, p. 79, 1915; No. 19. Bengal, Vol. XXIV, p. 96, 1915; No. 20. Chindwin, Vol. XXIV, p. 291, 1916; No. 21. Gwalior, Vol. XXIV, p. 309, 1916; No. 22. Koyna Valley, Vol. XXIV, p. 311, 1916; No. 23. Sikkim, Vol. XXIV, p. 468, 1916; No. 24. Sind, Vol. XXIV, p. 749, 1916; No. 25. Chin Hills, Vol. XXIV, p. 758, 1916; No. 26. Darjiling, Vol. XXIV, p. 773, 1916.

On the conclusion of the work recorded in "Report No. 26, Darjiling District," Baptista and his party moved eastwards about 60 miles to the Hasimara Tea Estate, where Mr. H. V. O'Donel had volunteered to supervise their work. The following note by Mr. O'Donel describes the country in which the present collection was made, between October 15th, 19, and May 10, 1916.

"The Hasimara Tea Estate, around which the collection was principally made, is situated in the Toorsa-Jainti Sub-Division of the Jalpaiguri District, or what is locally known as the Bhutan Duars (Gates of Bhutan). It lies on the east bank of the Toorsa River, some eight miles from the Bhutan Hills, about 26-50 N. Lat. and 89-20 E. Long. at an altitude of 500-600 feet.

"The rainfall is heavy, the average for the year being 150 inches.

"The country is more or less flat in appearance, but a decided slope leads up to the base of the hills.

"A fair portion of the District is under tea cultivation, the greater part however being occupied by heavy forest, with stretches of high grass and reed jungle; intersected by numerous streams, which are dry during the winter but become formidable torrents during the rains.

"The larger mammalia are well represented, the Elephant (*E. maximus*), the Gaur (*B. gaurus*), and Rhinoceros (*B. unicornis* and *sondaicus*) still occur, as well as *Bos bubalis*, *Rusa unicolor*, *Axis axis*, *C. duvaucelli*, *C. porcinus*, and *Sus salvanius*; Tigers and Leopards are plentiful and a few Himalayan Bear (*U. torquatus*) are also found. Among the smaller species which occur but were not procured by the Survey, *C. dukhunensis*, the Indian Wild Dog; *V. bengalensis*, Indian Fox; *F. bengalensis*, the Leopard Cat; *H. personata*, the Burmese Ferret Badger; *R. gigantea*, the Himalayan Giant Squirrel; *L. hispidus*, the Hispid Hare."

The collection consists of 886 specimens, belonging to 48 species and sub-species, in 38 genera.

No strikingly new form was obtained, and only two are new to the Survey lists, of which one (the porcupine) is doubtfully identified owing to too scanty material. As showing however the quantitative distribution of forms, these latter collections are most welcome.

Thus *Vandeleuria* has been represented in former collections by one or two specimens in each, while here we have a series of 50 specimens, showing that this animal is by no means so rare as we might have been led to believe by our past experience; and the Pigmy Shrew is another similar case.

(1) *MACACA RHESUS*, Audeb.

The Bengal Monkey.

Synonymy in No. 7.

♂ 2, ♀ 2, Hasimara; ♂ 1, Bharnbari.

(See also Reports Nos. 7, 14, 15, 19, 23 and 26.)

(2) *PTEROPUS GIGANTUS*, Bruenn.

The Common Flying Fox.

Synonymy in No. 2.

♂ 2, ♀ 2, Hasimara.

(See also Reports Nos. 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 15, 18, 19, 22 and 23.)

(3) *MYNODONTOMYS SORINX*, Vahl.

The Southern Short-nosed Fruit Bat.

Synonymy in No. 6.

♂ 3, ♀ 4, Hasimara; ♂ 1, Bharnbari.

(See also Reports Nos. 9, 11, 13, 14, 15, 18, 19, 20, 23 and 26.)

(4) ROUSETTUS LESCHENAULTI, Desm.

The Fulvous Fruit Bat.

Synonymy in No. 11.

♂ 1, Hasimara.

(See also Reports Nos. 11, 15, 16, 17, 22.)

(5) LYRODERMA LYRA, Geoff.

The Indian Vampire Bat.

Synonymy in No. 1.

♀ 1, Hasimara.

(See also Reports Nos. 4, 5, 6, 7, 8, 9, 12, 14, 15, 19, 22 and 23.)

(6) RHINOLOPHUS AFFINIS, Horsf.

The Allied Horse-shoe Bat.

Synonymy in No. 20.

♂ 1, Hasimara.

(See also Report No. 20.)

(7) HIPPOSIDEROS FULVUS, Gray.

The Bicoloured Leaf-nosed Bat.

Synonymy in No. 3.

♂ 1, Hasimara.

(See also Reports Nos. 5, 6, 7, 8, 9, 10, 12, 13, 14, 16, 17, 18, 19, 22, 23, 24 and 26.)

(8) BARBASTELLA DARJILINGENSIS, Horsf.

The Eastern Barbastel.

Synonymy in No. 26.

♀ 1, Hasimara.

(9) PIPISTRELLUS BABU, Thos.

The Babu Pipistrel.

Synonymy in No. 26.

♂ 3, ♀ 1, Hasimara.

(10) PIPISTRELLUS COROMANDRA, Gray.

The Coromandel Pipistrel.

Synonymy in No. 5.

♂ 5, ♀ 2, Hasimara; ♂ 4, ♀ 4, Bharnabari.

(See also Reports Nos. 9, 11, 13, 14, 15, 19, 23 and 26.)

(11) PIPISTRELLUS MIMUS, Wr.

The Southern Dwarf Pipistrel.

Synonymy in No. 1.

♂ 19, ♀ 20, Hasimara; ♂ 2, Bharnabari.

(See also Reports Nos. 1, 2, 5, 6, 7, 8, 9, 10, 11, 13, 15, 18, 19, 20, 23 and 25.)

(12) SCOTOZOTUS DORMERI, Dobs.

Dormer's Bat.

Synonymy in No. 1.

♂ 2, ♀ 2, Bharnabari.

(See also Nos. 2, 5, 7, 8 and 19.)

(13) SCOTOPHILUS KUHLI, Leach.

The Common Yellow Bat.

Synonymy in No. 1.

♂ 20, ♀ 16, Hasimara; ♂ 8, ♂ 7, Bharnabari.

(See also Reports Nos. 3, 5, 6, 7, 9, 12, 14, 15, 16, 19, 20, 23 and 24.)

(14) SCOTOPHILUS WROUGHTONI, Thos.

Wroughton's Bat.

Synonymy in No. 1.

♂ 3, ♀ 6, Hasimara.

(See also Reports Nos. 5, 6, 7, 9, 10, 11, 12, 15, 16, 18, 19 and 23.)

(15) HESPEROPTENUS TICKELLI, Blyth.

Tickell's Bat.

Synonymy in No. 5.

♂ 2, ♀ 3, Hasimara; ♀ 1, Bharnabari.

(See also Reports Nos. 6, 18 and 19.)

(16) HARPIOCEPHALUS LASIURUS, Hodgs.

The Hairy-winged Bat.

1847. *Noctilinia lasiura*, Hodgson, J. A. S. B., xvi, p. 896.

1851. *Lasiurus pearsoni*, Horsfield, Cat. p. 36.

1891. *Harpiocephalus harpyia*, Blanford, Mammalia, No. 200.

♂ 1, Hasimara.

(17) MYOTIS MURICOLA, Gray.

The Wall Bat.

Synonymy in No. 17.

♂ 16, ♀ 10, Hasimara.

(18) TUPAIA BELANGERI CHINENSIS, And.

The Sikkim Tree Shrew.

Synonymy in No. 23.

♂ 10, ♀ 3, Hasimara; ♂ 2, ♀ 2, Bharnabari.

(19) PACHYURA, SP.

The Musk Bat.

♂ 37, ♀ 38, Hasimara.

(See also Reports Nos. 1, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 22 and 23.)

(20) *PACHYURA HODGSONI*, Blyth.

The Himalayan Pigmy Shrew.

Synonymy in No. 15.

♂ 9, ♀ 16, Hasimara.

(See also Reports Nos. 16, 19, 23 and 26.)

(21) *SOBICULUS CAUDATUS*, Horsf.

Hodgson's Brown-toothed Shrew.

Synonymy in No. 15.

♂ 8, ♀ 5, Hasimara, ♂ 1, ♀ 1, Bharnabari.

(See also Reports Nos. 23 and 26).

(22) *FELIS PARDUS*, L.

The Panther.

Synonymy in No. 5.

♀ 1, Bharnabari.

(See also Reports Nos. 6, 9, 11, 13, 14, 16, 18 and 19.)

(23) *FELIS AFFINIS*, Gray.

The Jungle Cat.

Synonymy in No. 1.

♂ 1, Hasimara.

(See also Reports Nos. 3, 4, 5, 6, 7, 10, 11, 12, 15, 16, 18, 19, 20, 22 and 24.)

(24) *FELIS* (Domestic).

♂ 1, Hasimara.

(See also Reports Nos. 9, 11, 14, 15, 18, 19, 24 and 27.)

(25) *VIVERRA ZIBETHA*, L.

The Large Indian Civet.

Synonymy in No. 14.

♂ 4, ♀ 3, Hasimara; ♂ 2, ♀ 1, Bharnabari.

(See also Reports Nos. 20, 23, 25 and 26.)

(26) *VIVERRICULA MALACCENSIS*, Gmel.

The Small Indian Civet.

Synonymy in No. 3.

♂ 5, ♀ 4, Hasimara; ♂ 1, Bharnabari.

(See also Reports Nos. 5, 7, 10, 11, 12, 13, 15, 16, 18, 19, 20, 22, 23, 24 and 25.)

(27) *PARADOXURUS NIGER*, Desm.

The Indian Toddy Cat.

Synonymy in No. 5.

♂ 6, Hasimara; ♂ 1, Bharnabari.

(See also Reports Nos. 7, 8, 11, 13, 15, 18, 19 and 22.)

Some of these specimens correspond with the type of *viciatus*, Schwarz, while some are quite normal and even in the dentition I can appreciate no

difference between the two forms. Schwarz relies largely on the yellow suffusion and gives the habitat as Assam, it may be that later we may find that all the animals in Assam show this yellow suffusion in which case there may be reason to accept *ricinus* as a subspecies, but in the meantime I think it is safer to use the specific name *niger*.

(28) MUNGOS MUNGO, Gmel.

The Common Bengal Mongoose.

Synonymy in No. 19.

♂ 2, Hasimara.

(See also Reports Nos. 21 and 23).

(29) MUNGOS AUROPUNCTATUS, Hodgs.

The Small Indian Mongoose.

1836. *Mangusta auropunctata*, Hodgson, J. A. S. B., v., p. 235.

1888. *Herpestes auropunctatus*, Blanford. Mammalia, No. 58.

♂ 16, ♀ 2, Hasimara; ♂ 1, ♀ 3, Bharnabari.

We have already had occasion to take *pallipes* out of Blanford's synonymy of this species, and *persicus* is equally distinct, *nepalensis* has hitherto been represented only by Gray's original three lines of description; recently however, Mr. Thomas, in going through a number of stuffed specimens, withdrawn from public exhibition, was able to identify one of them as the type of Gray's *H. nepalensis*. It now appears that, though the two animals closely resemble each other in many respects, *nepalensis* is distinguishable by its finer pattern. The type locality of *nepalensis* is given by Gray as "N. India." It appears to be a rare animal. The National Collection contains no specimen except the type, and from its absence from the long series collected by Hodgson in Nepal, and from his drawings, it seems very doubtful whether it occurs at all in that country. On re-examining the Surrey stock I find that Mr. Crump obtained two specimens in Midnapur, recorded in the Bengal, Behar and Orissa Report, under the name of *auropunctatus*, which appear to me to represent *nepalensis*.

In the circumstances it will be interesting to record some measurements of the two species:—

	<i>auropunctatus</i> .		<i>nepalensis</i> .	
	♂	♀	♂	♀
Head and body ..	300	290	300	275
Tail ..	237	238	217	221
Hindfoot ..	53	52	52	49
Ear ..	20	20	22	23
Skull ..				
Condyle-basal length ..	61	61	61	60
Zygomatic breadth ..	29	29	29	28
Interorbital breadth ..	14	10	11	10
Nasal length ..	13	12	15	16
Palatine length ..	32	33	32	30
Greatest length of caninial ..	7.3	7.5	7	7

(30) MUNGOS URVA, Hodgs.

The Crab-eating Mongoose.

Synonymy in No. 23.

♂ 1, ♀ 1, Hasimara.

(See also Report No. 25.)

(31) MARTES FLAVIGULA, Bodd.

The Northern Indian Marten.

Synonymy in No. 15.

♀ 1, Hasimara.

(See also Reports Nos. 20, 23 and 25.)

(32) CANIS INDICUS, Hodgs.

The Bengal Jackal.

♂ 1, ♀ 1, Hasimara.

(See also Reports Nos. 14, 15, 16, 19, 20, 23 and 25.)

(33) PTEROMYS (HYLOPETES) ALBONIGER, Hodgs.

The Parti-coloured Flying Squirrel.

Synonymy in No. 20.

♂ 1, Hasimara ; ♀ 1, Bharnabari

(See also Reports Nos. 23, 25 and 26.)

(34) TOMETTES LOKROIDES, Hodgs.

The Hoary-bellied Himalayan Squirrel.

Synonymy in No. 23.

♂ 4, ♀ 7, Hasimara ; ♂ 9, ♀ 1, Bharnabari.

(See also Report No. 26.)

(35) VANDELEURIA DUMETICOLA, Hodgs.

Hodgson's Tree Mouse.

Synonymy in No. 16.

♂ 17, ♀ 17, Hasimara ; ♂ 8, ♀ 7, Bharnabari.

(See also Reports Nos. 23, 25 and 26.)

(36) MUS DUBIUS, Hodgs.

The Nepal House Mouse.

Synonymy in No. 15.

♂ 19, ♀ 19, Hasimara.

(See also Reports Nos. 23 and 26.)

(37) MUS HOMOURUS, Hodgs.

The Himalayan House Mouse.

Synonymy in No. 15.

♂ 6, ♀ 8, Hasimara ; ♂ 6, ♀ 5, Bharnabari.

(See also Reports Nos. 23 and 26.)

(38) *MUS BOODUGA*, Gray.*The Southern Field Mouse.*

Synonymy in No. 1.

♂ 29, ♀ 55, Hasimara; ♂ 33, ♀ 40, Bharnabari.

(See also Reports Nos. 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 18, 19, 20, 21, 22 and 25.)

(39) *RATTUS RUFESCENS*, Gray.*The Common Indian Rat.*

Variety with white underparts:—

♂ 66, ♀ 60, Hasimara.

(See also Reports Nos. 5, 6, 7, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25 and 26.)

(40) *GNOMYS BENGALENSIS*, Gr. and Hardw.*The Bengal Mole-Rat.*

Synonymy in No. 19.

♂ 17, ♀ 21, Hasimara.

(See also Reports Nos. 20, 23 and 26.)

(41) *BANDICOTA ELLIOTIANA*, And.*The Bengal Bandicoot.*

Synonymy in No. 19.

♂ 3, ♀ 2, Hasimara.

(See also Reports Nos. 19 and 27.)

(42) *GOLUNDA ELLIOTI*, Gray.*The Indian Bush Rat.*

Synonymy in No. 1.

♂ 8, ♀ 6, Hasimara.

(See also Reports Nos. 2, 4, 5, 6, 7, 11, 15, 19 and 22.)

(43) *ACANTHION HODGSONI*, Gray.*The Crestless Himalayan Porcupine.*1847. *Acanthion hodgeoni*, Gray, P. Z. S., p. 101.1847. *Hystrix alophus*, Hodgson, J. A. S. B., xvi, p. 771.1891. *Hystrix hodgeoni*, Blanford, Mammalia, No. 316.

♂ 1, Hasimara.

The specimen is a head—skin and skull of a quite young animal, there is however no sign whatever of a crest, showing that it is not *leucurus*. I can find no authentic record of any specimen of *bengalensis* having been taken since Blyth described the species, and I have not access to the type. For the present it will be safest to call this specimen *hodgeoni*. Hodgson himself called the animal *alophus* but his description was not published till August, while Gray's appeared in June. A good series of these small crestless porcupines is a great desideratum, for though Blyth writes of it as the "common Bengal Porcupine" the National Collection contains only one or three specimens of *hodgeoni* contributed by Hodgson himself, and none of anything resembling *bengalensis*.

(44) *LEPUS RUFICAUDATUS*, Geoff.

The Bengal Hare.

Synonymy in No. 15.

♂ 11, ♀ 1, Hasimara ; ♂ 1, Bharnabari.

(See also Reports Nos. 19, 21, 23 and 26.)

(45) *MUNTIACUS VAGINALIS*, Bodd.

The Bengal Rib-faced Deer.

Synonymy in No. 20.

♂ 1, Hasimara.

(See also Report No. 23.)

(46) *RUSA UNICOLOR*, Bechs.

The Sambhar.

Synonymy in No. 5.

♀ 1, Bharnabari.

(See also Reports Nos. 11, 15, 18 and 22.)

(47) *SUS ORISTATUS*, Wagn.

The Indian Wild Boar.

Synonymy in No. 5.

♀ 1, Hasimara.

(See also Reports Nos. 8, 10, 11 and 22.)

A LIST OF BIRDS FROM THE NORTH CHIN HILLS.

BY

J. C. HOPWOOD, I.F.S., M.B.O.U.,

AND

J. M. D. MACKENZIE, I.F.S., B.A.

This list is the result of three short trips at dates varying from April 20th to May 18th. In 1913, Hopwood went up to the hills on May 6th and came down on May 16th, in 1914, he and I went up together on April 22nd and came down on May 9th, and in 1915 I was up in the hills alone from April 20th to May 18th. Travelling in the hills is exceedingly difficult and expensive, and except in 1913 the weather was unspeakably bad; in all three years, we had a certain amount of illness, and a good deal of work had to be done, ornithology perforce taking second place; added to this, we both plead guilty to a desire for getting nest and eggs with the birds secured. These things account for the somewhat meagre list produced. It is given for what it is worth, as several very rare birds were found, and the district itself is interesting, lying between Manipur worked by Hume, and the Chin Hills worked by Col. Rippon and Capt. F. E. W. Venning, the former at Mt. Victoria, the latter at Haka. A little further North, on the South of Assam lie the unexplored (and unadministered) ranges of hills inhabited by Chins, Nagas, Abors, etc., including Mt. Saramatti, the highest mountain in Burma, of which the ornithology is absolutely unknown, except by inference.

In the hope of adding a little to what has been recorded from this part of the world, which has been very little worked, we venture to give a list which has no pretensions to being perfect; quite on the contrary, it comprises merely the commoner birds occurring in the summer. Only one or two specimens shot in the cold weather (and these all low down) are included; unless otherwise stated, all the birds given were secured between April 20th and May 18th. The numbers in brackets refer to the Fauna of British India, and trinomials, when used, are either those given by the late Col. H. H. Harington, in his notes on the "Indian Timeliides and their allies", (J.B.N.H.S., June 1914, *et seq.*), or those in Mr. E. C. Stuart Baker's Indian Pigeons and Doves.

Our thanks are due to both these gentlemen for a great many very useful hints, and for very kindly working out some of the skins obtained.

The area worked was about 23° 45' N. Lat. and 94° 0' E. Long.; it is actually that part of the Chin Hills at present included in the

Upper Chindwin forest division. The Northern boundary is Manipur, the Western the main chain of the Chin Hills, the Southern the main watershed of the Nankathit Chaung, and the Eastern, the upper Chindwin Civil District, in all an area some 30 miles square. The country consists of steep hills rising up to nearly 7,000' with deep valleys (down to 2,000' or 1,500') between. The hills are covered with jungle, mostly of a scrubby nature (oaks, chestnuts, rhododendrons, and tree heather with an undergrowth of bracken, raspberry, etc.) mixed with patches, occasionally big, of dense evergreen jungle which are especially noticeable along the main Western ridge. There are also a few areas covered with an open growth of pine. Close to villages, "Pónzós" of all ages occur; these are patches cleared for shifting cultivation and abandoned after one or more years. They are dense thickets of small trees of varying ages, elephant grass, grass, and weeds. The streams are all perennial, rocky, swift, and liable to sudden floods, and the valleys near them are generally covered with dense evergreen or semi-evergreen jungle, replaced higher up by bamboos and undergrowth with a few big trees, the higher parts being oak scrub. One area deserving special notice is a wind trap, through which the main road to Tiddim and Fallam passes. It is said by the Chins never to be without a wind; when an ordinary breeze is blowing in other places, a gale is blowing here and when there is a gale elsewhere, it is impossible to stand. Consequently there are no trees, nothing in fact but short grass, and one or two juniper-like shrubs, although the jungle round is rather fine. I was unable to get to it in 1915, owing to fever, and so could not verify the previous year's identifications which had been made in a hurry, without shooting birds. The area is about 2 miles long, and from a quarter to half a mile across.

The measurements given are in inches and decimals.

[Note.—As Mr. Hopwood is on leave, I am writing these notes out here. He has seen a rough copy, and made additions and corrections; but in re-writing I have occasionally used the first person, which is however intended to always include both of us unless the context shows the contrary.—D. M.]

1. The Jungle Crow—*Corvus macrorhynchus*. (4)
Not common.
2. Indian House-Crow—*Corvus splendens*. (8)
3. Red-billed Blue Magpie—*Urocissa occipitalis*. (12)
Foothills only as a rule. Obtained one nest in 1914, on the Manipur boundary at 3,500'.
4. Green Magpie—*Cissa chinensis*. (14)

Nest and eggs of the usual type found at 3,000' on 7th May 1913, 12th May 1913 and 21st April 1914. Shot a bird only in 1915.

5. Indian Tree-pie—*Dendrocitta rufa*. (16)

Foothills only. Nest with 6 eggs on 5th May 1913 and 2 nests on 20th April 1915 in the plains at the foot of the hills.

6. Himalayan Tree-pie—*Dendrocitta himalayensis*. (18)

Very common at about 4,000'. We both got nice series of eggs at dates varying from April 20th to May 16th. The normal clutch was, I think, 4, but several nests, containing 3 hard set eggs only, were found.

7. Indo-Chinese Jay—*Garrulus oatesi*. (26a)

This rare bird was found in moderate numbers. We took 9 nests in 1915 and others in 1913 and 1914, the records of which are as follows:—

- 14th May 1913, C/3., Hard set.
- 28th April 1914, C/1., Fresh.
- 30th April 1914, C/3., Fresh.
- 29th April 1915, C/4., Set.
- 29th April 1915, C/4., Fresh.
- 22nd April 1915, C/5., Set.
- 1st May 1915, C/3., Set.
- 27th April 1915, C/4., 3 young birds, and one addled egg.
- 24th April 1915, C/3., Fresh.
- 29th April 1915, C/4., Set.
- 27th April 1915, C/4., Fresh.
- 27th April 1915, C/4., Very hard set.

It seems that the usual time for nesting is April, but a few nests may be taken on into May.

The bird is a very wily customer, and shy, and it was only with the greatest difficulty that I was able to shoot one off the nest. We failed in 1913. In 1914 the single egg taken on 28th April 1914, was found on 25th April 1914, and we spent many a cramp-stricken hour trying for the bird which would not come in shot; eventually we had to take the egg, as we were moving camp. However in 1915, I got 2 birds off the nest, and one was trapped on the nest by a Chin. Owing to the bad weather, the skins came down in a terrible state.

The eggs were of the usual garruline type and show the usual amount of variation, but the birds do not seem to build in colonies as *G. leucotis* does at Maymyo, and the nests are placed somewhat higher above the ground. One of my clutches has a very light sage green background thickly speckled equally all over with sage-green, with underlying markings of a fainter greenish grey, and some gloss. One or two dark brown hair streaks on the large end. In this clutch only one egg has traces of a ring, but generally a ring or cap is distinctly visible at the large end. The shape is a pointed oval with the big end rather more inclined to be pointed than usual. Texture, rough; grain coarse to normal; the shell of normal thickness, strong, fairly hard and opaque; surface slightly pitted.

In another clutch, the colour is rather brownish, and the markings are all more numerous at the large end. A third has a brownish white background with brownish-green spots (almost olive green); a fourth clutch is mottled with olive, the superficial markings being few.

There are almost always dark brown hair like streaks on the eggs when found, but these wash off in blowing unless great care is taken. The streaks are very irregular and generally look like the track of an inky fly; they are like the forked lightning of tradition in shape, and may be as much as an inch in length; they are up to 1/50 of an inch broad.

I think the normal clutch is 4, but I have found 5, and have several times taken 3 hard set eggs.

The nest is a shallow sancer, in a low tree, made of roots with sometimes a very little moss outside. Externally, it measures $6'' \times 2\frac{3}{4}''$, with the hollow $4\frac{1}{2}'' \times 2''$. It is placed at some little distance from the ground (10 to 15 feet) in fairly open jungle; in spite of this, it is well concealed and not at all easy to 'spot'.

The bird was first shot in the Kabaw Valley by Thomson of the Forest Department and sent to Oates for identification. Since then, it has been shot by the late Col. Harington and by both of us in the Kabaw Valley, in the Upper Chindwin district, and by me on the hills lying on the East of the Kabaw Valley at 2,500', in all cases in the cold weather. It is by no means rare in the area now under discussion in April-May-June, but is said by the Chins to be much less common, or absent altogether in winter. I believe the bird has never been seen in the Kabaw Valley in the hot weather, and its nest has never been found except in the Chin Hills, always at of 4,000' to 6,000'. This seems to be a case of partial migration from the low valleys to the hills for breeding purposes such as has been noted in other jays, and might be expected in this bird.

The average size of 28 eggs is $1.19'' \times .90''$, the length varying from $1.05''$ to $1.32''$, and the breadth from $.85''$ to $.93''$.

8. Indian Grey Tit—*Parus atriceps*. (31)

Shot a bird on the Burma boundary at 2,000'.

9. Green-backed Tit—*Parus monticola*. (34)

Fairly common.

10. Hume's Red-headed Tit—*Egithaliscus manipurensis*. (36)

Two nests, each containing 3 eggs, with parent birds brought in on 25th April 1914 (Fresh) and 12th May 1913 (Hard set). Four nests in 1915, all of the same type. They were beautifully made little structures, hanging from a twig, twice in dense, and twice in open jungle. They were made of the finest stems of grass (i.e. that part attaching the seed to the main stem "grass-seed stems") plastered all over with cobwebs, lichens, moss, fragments of grass, and leaves, feathers, etc., with a thick and wonderfully soft lining of feathers. The whole thing, when crushed, springs back to its original shape like a sponge. The bird appears to have a penchant for bright feathers for the lining (minivets, jungle fowl, *Phasianus hainia*, etc.) which may be due to a desire for a bright and cheerful internal decoration scheme, but which I think is probably due to their being easier to find.

The average size of 8 eggs is $.52'' \times .41''$, length from $.51''$ to $.55''$ and breadth from $.40''$ to $.42''$. The particulars of 5 clutches are:—25th April 1915, c/4, Set; 22nd April 1915,

c/5, Hard set; 6th May 1915, c/4, Fresh; 12th May 1913, c/3, Set; 25th April 1914, c/3, Fresh. The usual time appears to be April, the normal clutch 3 to 5. The eggs are exceedingly fragile and white with a faint purplish ring round the large end. I have one egg showing a distinct ring of reddish purple speckles overlying a sub-surface clouded ring of faint purple. In this egg there are one or two speckles scattered over the rest of the egg, but in my others the marking is confined to the ring, which is a faint purple; and there are one or two speckles on the ring of reddish purple (faint). One egg has only a very faint, clouded, discontinuous ring, almost invisible. The ordinary egg is white with a faint clouded purplish ring at the large end on which may be a few distinct speckles of reddish purple. The gloss is only very slight.

11. Black-spotted Yellow Tit—*Machlolophus spilonotus*. (41).

Shot several birds, and found 3 nests containing 9 eggs. As they were all hard set and I found a nest with young, this bird probably breeds early in April. Average size of 7 eggs, $.73'' \times .54''$, length from $.70''$ to $.75''$, breadth from $.52''$ to $.56''$. Nest and eggs both of the usual tit type.

12. Austen's Crow-Tit—*Paradoxornis guttaticollis*. (52).

Two birds, with nests; each contained one fresh egg, $.92'' \times .64''$ and $.87'' \times .65''$ in 1915. Nests typical: 3 nests, containing 2 eggs each in 1914.

13. *Suthora* subsp. nov.

Close to *Suthora poliotis ripponi*. It has not yet been described for want of more specimens. A single specimen, noted by Harington in his notes on the *Timeliides*, was obtained in May 1913. It was snared by a Chin, and we never saw another specimen, though we tried hard for more in 1914 and 1915. The nest was not procured.

14. Hoary-headed Crow-Tit—*Sceerhynchus gularis*. (61).

(*Pittiparus gularis transflavialis*) nests and eggs. Nests resemble those of *P. guttaticollis* but the eggs are very different, being less fragile, and blotched pretty well all over with greyish and yellowish brown. The eggs measure about $0.78'' \times 0.62''$. Dates as follows:—C/2 26th April 1914, c/2 28th April 1914, c/2 29th April 1914, c/2 1st May 1914, c/3 4th May 1914, c/2 4th May 1914, and two young birds, fully fledged, about the same date. Several more nests in 1915.

15. Rufous-necked Laughing-Thrush—*Dryonastes ruficollis*. (62).

Nest 1914 at 2,000'. Foothills only.

16. Austen's Laughing-Thrush—*Dryonastes galbanus*. (68).

Early common at about 5,000', but appears to be local. Mr. E. C. Stuart-Baker quotes Hopwood as saying that the nest and eggs resemble those of *D. ruficollis*. The nest certainly does, but none of the eggs actually taken by either of us had the slightest trace of blue. Mr. Stuart-Baker has a blue clutch ("markedly indistinguishable from the eggs of *D. ruficollis*"), and several nests of *D. galbanus* containing blue eggs were

brought in to me, in 1915; but I never got the bird off a blue clutch, and these eggs may have been substituted by the finders. Mr. Stuart-Baker's blue clutch shows that the bird may lay blue or white eggs, in the same manner as *D. sannio*.

The nest is generally built in the fork of a low bush or shrub, 2' to 10' high, in fairly open jungle, and is not difficult to see. Outside it is roughly made of grass-stems with the ends left sticking out untidily in all directions and is lined with yellow grass seed stems; in shape it is a large flattish cup, and there are often a few moss roots, and small twigs mixed with the main structure of the nest (but not with the lining). The general effect is a brown outside, lined yellow, as opposed to *I. cineracea* of which the nest is brown outside, lined black.

The eggs number 2 or 3 in a clutch (I only once found 4) and those of which we are sure were white, but there may be blue eggs as well. They are glossy, and of a satiny texture, but this, as well as the gloss, varies considerably. The shell is of medium thickness, fairly hard, and opaque, the grain is normal to fine; the surface is sometimes smooth, sometimes closely and minutely pitted. The average size of 45 eggs is 1.02" x .73", length varying from .93" to 1.09" and the breadth from .70" to .79". In shape, they are typically rather pointed, the large end being roundish, and the small end tapering considerably. The eggs appear liable to a good deal of variation in all respects, and begin to be laid about May; we only found a few in April.

17. Himalayan White-Crested Laughing-Thrush—*Garrulax leucolophus*. (69).

Common.

18. Black-gorgetted Laughing-Thrush—*Garrulax pectoralis*. (72).

Common.

19. Necklaced Laughing-Thrush—*Garrulax moniliger*. (73).

The above 3 species inhabit the bamboo jungle in the valleys.

20. McClelland's Laughing-Thrush—*Garrulax gularis*. (74).

I shot a bird which I identified as this in 1915, but the skin was very badly smashed up, and I am doubtful.

21. Ashy Laughing-Thrush—*Ianthocincla cineracea*. (79).

This is the common laughing thrush of the district, being exceedingly abundant between 4,000' and 6,000', and breeding in the raspberry canes and thickets near the villages. We obtained a large number of nests and eggs at the end of April, and beginning of May. The laying season seems to extend for about a month, as we got both hard set and fresh eggs almost every day. The earliest incubated eggs were found on April 20th; this is different from *D. galbanus*, which does not begin to breed till about the beginning of May. (My earliest eggs were a fresh clutch on 27th April 1915.)

The nest is a small and flimsy copy of that of *G. pectoralis*, and is generally fairly conspicuous; the bird, obliged by sitting on it until you almost touch her, thereby rendering examination easy. The nests were generally placed in low situations

bushes, 3' to 6' high, and made of grass stems and fine twigs, not very tidily put together, as all the ends stick out. The lining is of fine black and brown stems and a few moss roots, (see *D. galbanus*). In shape, a hollow saucer, about $4\frac{1}{2}$ " across and 2" deep externally, and $3" \times 1\frac{1}{2}$ " internally. Except for the lining, the nest and situation are very similar to those of *D. galbanus*. Both birds breed fairly high up, at altitudes of 3,000' and over.

In shape and colour, the eggs are very like those of *T. virgatum*, and *T. lineatum*, being a little smaller on the whole. The average size of 59 eggs is $1.01" \times .74"$, the length varying from .91" to 1.08" and the breadth from .69" to .79". I have one egg which is 1.15" long, which is not included above, as it may possibly belong to a cuckoo.

22. Hume's Chestnut-headed Laughing-Thrush—*Trochalopteron erythrolaema*. (83). (*T. erythrocephalum erythrolaema*).

Secured 7 nests, containing 12 eggs in 1915, mostly at the end of April. I am not quite certain what to make of this bird's eggs and nests. Hopwood got his first nest on 12th May 1913. "With parent bird, in bamboo scrub on the extreme summit of a hill, at about 6,000'; the nest was a massive cup of moss lined with roots, and was placed in a small very thick ever green shrub about 4' from the ground." Subsequently, in 1915, I came to the conclusion that the nest was generally placed 4' to 8' from the ground, and is—at times at least easily visible. They are massive deep cups of grass stems and twigs lined with fine twigs, moss roots, and roots fairly loosely put together. Some of the eggs are of a peculiar elongated shape, more or less elliptical; others are shorter. In my own series, the ground colour was bright blue marked with dark blotches, spots, and streaks varying from dark purplish brown to black in colour, and in size from 0.1" in diameter to mere specks. In one or two eggs, the spots are numerous round the large end, in another, there are only about a dozen small specks; the usual type is intermediate, i.e., a few markings of various sizes scattered over the large end, and only one or two on the small end. Again, I have some eggs in which the surface is almost chalky, and rough, with very little gloss; I think these must be due to immature hens; the typical egg is glossy, with a satiny texture, giving the appearance of the background of a wedgewood plaque. The shell is rather soft, and thickish, and the grain normal.

Average size of 14 eggs is $1.20" \times .80"$. This is, I think due to the elongated eggs mentioned above. I think a more normal size would be say $1.20" \times .83"$. The length varies from 1.10" to 1.30" and the breadth from .72" to .85". They are generally less broad than those of *T. caryopterum*, and *T. erythrocephalum* which I have in my collection, but in this connection, I think all the measurements of eggs seem smaller in the Chin Hills than in Cachar, and Assam.

23. Assam Crimson-winged Laughing-Thrush—*Trochalopteron phainoceros bakeri*. (87 a).

Obtained nests in all 3 years, the clutch being either 2 or 3 (generally the former). The nests were generally placed in

bamboos, and nests and eggs were precisely similar to typical *T. phoeniceum*.

24. Manipur Streaked Laughing-Thrush—*Trochalopteryx virgatum*. (98).

Moderately common: breeds a little later than *I. cineracea*: i.e., the first incubated eggs I got were in May 2nd. The nest is generally built in thick bushes in open jungle, or in the grass round the base of a bush. It is a neat structure made of grass and bamboo leaves outside, then a few ordinary tree leaves (dry) and creeper stems, lined with fine grass and rootlets. It is generally very thick at the bottom. The eggs are indistinguishable from those of *T. lineatum*. Average size of 22 eggs $1.03'' \times .75''$, length varying from $.95''$ to $1.12''$, and the breadth from $.72''$ to $.79''$.

25. Austen's Striated Laughing-Thrush—*Grammatoptila striata austeni*. (102).

Nest with 3 fresh eggs on 29th April 1914. Both nest and eggs very similar to those of *G. pectoralis*.

26. Spotted-breasted Laughing-Thrush—*Stactocichla merulina*. (103).

Nest with 2 eggs and parent bird on 27th April 1914; as described in Harington's notes.

27. Grant's Scimitar Babbler—*Pomatorhinus schisticeps mearsi*. (116 a).

Only found in the foot hills.

28. Phayre's Scimitar Babbler—*Pomatorhinus ferruginosus phayrei*. (24).

The birds are not uncommon, and one or two nests were obtained. c/3., Fresh, 24th April 1914. c/3., Hard set, 10th May 1915.

29. Baker's Rufous-necked Scimitar Babbler—*Pomatorhinus ruficollis bakeri*. (125).

Fairly common. Took eggs in 1913 and 1914 but none in 1915.

30. McClelland's Scimitar Babbler—*Pomatorhinus erythrogastrus maccllellandi*. (130).

Extremely common. Normal clutch, 3.

31. Burmese Spotted Babbler—*Pellorneum ruficeps minus*. (143).

Foothills.

32. Rippon's Babbler—*Pellorneum ignotum cinnamomeum*. (148 a).

Occurs, not rare. The nest is generally in the lowest branches of a thickish bush 1' to 4' high, being worked in with the grass around, if there is any. I found one nest on the ground built into the roots of a tree, from which the soil had been washed away. The nest is built of grass on a foundation of bamboo leaves with a lining of moss roots, and is nearly always domed, often very slightly. The eggs number 2 to 4, generally 3, and are reddish white, freckled all over with red-brown markings generally to form a cap, or ring round the large end. In shape,

they are generally ovals, with bluntish ends. The gloss varies, but the eggs are generally fairly glossy. The average size of 22 eggs is $\cdot 80'' \times \cdot 59''$, length from $\cdot 78''$ to $\cdot 84''$, and breadth from $\cdot 57''$ to $\cdot 62''$.

33. Tickell's Babbler—*Drymocapthus tickelli*. (151).

Found nests and eggs which were referred to this species by Mr. E. C. Stuart-Baker.

34. Nepalese Babbler—*Alcippe nepalensis*. (163).

Common at the higher levels. It is replaced lower down by

35. The Burmese Babbler—*Alcippe phaeocephala phayrii*. (165).

Nest, eggs and birds of both species were obtained.

36. Assam Black-throated Babbler—*Stachyris nigriceps coltarti*. (169 a).

Shot one bird. Apparently not common.

37. Hume's Babbler—*Stachyridopsis nigrifrons*. (173).

Obtained one clutch of eggs referred to this species, but did not get the bird.

38. Yellow-breasted Babbler—*Mixornis rubricapillus*. (176).

A bird shot in 1913.

39. Assam Tit-Babbler—*Schaniarus dubius mandellii*. (179).

Very common.

40. *Myiophoneus*, sp.

Identified it as *engeni* in a hurry; according to Oates, F.B.I., it should be *temmincki*; probably intermediate. Fairly common along all streams. 7 eggs average $1\cdot 31'' \times \cdot 98''$.

41. Grey Sibia—*Lioptila gracilis*. (205).

Occurs at the highest levels, generally in pine forest. It is said by the Chin, who is a very nimble shot with his bow and pellets, to be one of the most difficult birds to shoot, as it runs along the branches, in and out of leaves, and keeps among thick foliage. The nest is very firm and neat, placed in a fork, generally of a pine and is made of grass stems, plastered outside with grass, leaves, cobwebs and some moss, all worked in with the green needles of the pine, and lined with grass-seed stems and rootlets. The nests were found between 1st and 5th of May, at 5,000' to 8,500'; the eggs were fresh and numbered 2 to the clutch. There are two varieties of egg; one bluish grey, like blackbirds, and the other (the less common of the two) distinctly pinkish. The general freckled character of the markings is smaller in both cases. The shell is very thin and fragile. The average size of 5 eggs is $\cdot 91'' \times \cdot 67''$. Length from $\cdot 89''$ to $\cdot 94''$ and breadth from $\cdot 65''$ to $\cdot 71''$.

42. Rippon's Bar-wing—*Actinodera egertoni ripponi*. (211b).

Fairly common. Builds a largish nest, generally in a low bush (3 to 6' high) carefully made of roots and grass stems, surrounded by bamboo leaves and moss, the whole thing being nicely

rounded off. There is generally some lining of fine moss roots. Clutches number 2 or 3, and the average size of 29 eggs is .89" x .66", length varying from .80" to .97" and breadth from .60" to .71".

43. Chestnut-headed Staphidia—*Staphidia castaneiceps*. (216).

The nest is generally in a hole in a bank; I have a distinct recollection of finding at least one nest in the lowest branches of a small bush, but I cannot find any record of it in my rough notes. The nest is made of moss thickly lined with bark fibre, and grass seed stems, making a neat cup. The eggs are white with a faint bluish or greenish tinge, speckled pretty well all over with fairly large brown spots, with which are mixed a few pale purple ones. The average size of 44 eggs is .66" x .52", length varying from .60" to .71" and breadth from .50" to .56". I found one clutch of 4 eggs, but the usual number is 3 and sometimes 2 eggs only.

44. Stripe-throated Yuhina—*Yuhina gularis*. (223).

Shot a bird identified as this. The skin was very bad, and I was not certain about it. It was probably *Y. G. yangpiensis* (Sharpe).

45. Swinhoe's White-eye—*Zosterops simplex*. (228).

Two nests and birds. The nests were hung between 2 twigs and made of cobwebs, lichens and grass lined with grass seed stems and vegetable pappus. It is very flimsy and small, but seems fairly tough.

46. Yellow-naped Ixulus—*Ixulus flavicollis flavicollis*. (232).

Nest, (1) on the ground, in the roots of a tree, (2) a cradle-like arrangement, hung between 2 twigs. The one on the ground was a well made cup of moss, lined with moss roots. I found a clutch of 2 eggs hard set on April 29th. Six eggs average .75" x .56", length varying from .73" to .77" and breadth from .55" to .58".

47. Red-billed Liothrix—*Liothrix lutia callipygus*. (235).

Nests and eggs.

48. Nepalese Cutia—*Cutia nepalensis*. (236).

Common. Saw a couple of birds collecting moss on May 16th, 1913, but failed to get eggs.

49. Red-winged Shrike-Tit—*Pteruthius erythropterus*. (237).

Common. Did not find nest.

50. Chestnut-throated Shrike-Tit—*Pteruthius melanotis*. (239).

Got two clutches of this; c/2, 25th April 1914; and c/3, May 1914.

51. The Common Iora—*Egithina tiphia*. (243).

Common. Failed to get nests and eggs.

52. Orange-bellied Chloropsis—*Chloropsis hardwickii*. (249).

Obtained birds and nests; all the eggs were broken.

53. Sultan bird—*Melanochlora sultanea*. (253).

Seen at Madan, 1913. Shot a bird from a flock at 3,500' in 1915.

54. Silver-eared Mesia—*Mesia argenteauris*. (257).

Several nests and eggs in all years.

55. Burmese White-throated Bulbul—*Criniger burmanicus*. (264).

One nest found, but the eggs were on the point of hatching, and could not be preserved.

56. Himalayan Black Bulbul—*Hypsipites psaroides*. (269).

Common. Nests and eggs.

57. Rufous-bellied bulbul—*Hemixus macclellandi*. (275).

Nest, with 2 eggs, found in June, 1913, and in other years.

58. Burmese Red-vented Bulbul—*Molpastes burmanicus*. (279).

Very common.

59. Blyth's Bulbul—*Xanthicus flavesens*. (287).

Common. Took several nests.

60. Black-crested Yellow Bulbul—*Otocompsa flaviventris*. (290).

Very common. Numerous nests at about 2,000'.

61. Finch-billed Bulbul—*Spizixus canifrons*. (292).

Fairly common. The nest always appears to be made of corkscrewlike tendrils of some vine which are plaited together to form a shallow saucer. There is no lining, or only traces of fluff or grass. It generally builds in scrub jungle 8' or 10' high. The first nest was found on the extreme top of the local mountain at Haingyan (6,300'). Size of the eggs, about 1.01" x .68".

62. Cinnamon-bellied Nuthatch—*Sitta cinnamomeiventris*. (316).

Shot one at 1,000'.

63. Beautiful Nuthatch—*Sitta formosa*. (324).

Three nuthatch eggs were brought in to me by a Chin, measuring .76", .79" and .78" by .55", .54", .54" with the shattered remnants of a bird, which I think was this.

64. Velvet-fronted Blue Nuthatch—*Sitta frontalis*. (325).

Not rare at 3,000' and over. Nest and eggs in 1915. o/s, measuring .64" x .52", 24th April 1915. Nest with young in a small hollow tree, 9th May 1913. The birds were entering through a hole made by a chopper.

65. Black Drongo—*Dicrurus ater*. (327).

Common.

66. Grey Drongo—*Dicrurus cineraceus*. (333).

Common.

67. Bronzed Drongo—*Chaptalia cinn*. (334).

Not common. Nests and eggs taken.

68. Hair-crested Drongo—*Chibia hottentotta*. (335).

Common.

69. Lesser Racket-tailed Drongo—*Bhringa remifer*. (339).

Very common. The birds nest very low down here, often in a fork of a bamboo within reach of the hand.

70. Mt. Victoria Tree-Creeper—*Certhia victoriae*. (344a).

Shot a bird, identified as this by the late Col. Harington, in the south of the area, and another identified by us in 1914 as the next species in the North.

71. Hume's Tree-Creeper—*Certhia manipurensis*. (345).

Shot off the nest a bird identified as this, in the extreme north of the area. Probably in this area, the forms are intermediate, approaching *C. manipurensis* in the north, and *C. victoriae* in the south. The bird identified by us as *C. manipurensis* was shot on the Chin Hills—Manipur boundary, (actually, I think about 2 yards inside Manipur). We obtained 2 nests with eggs of this bird, the eggs being of the ordinary type, and measuring .67", and .69" x .50". c/3, slightly set, 29th April 1914 and c/4 1st May 1915 (one egg broken), measuring .64", .64", .64" x .45", .45" and .47". The nests were in both cases pads of fibres, moss, and a few roots, with a feather or two in the lining, not large, and scarcely hollowed out at all in the centre, placed in holes in small trees, at 8' and 10' high. Elevation 6,000'.

72. Mt. Victoria Wren—*Urocichla oatesi*. (355 b).

Eggs and nest, c/3, hard set, on 5th May 1914.

73. Indian Tailor Bird—*Orthotomus sutorius*. (374).

Nest, and bird, at 2,500'.

74. Franklin's Wren-Warbler—*Franklinia gracilis*. (382).

75. Beavan's Wren-Warbler—*Franklinia rufescens*. (383).

76. Tenasserim White-tailed Willow-Warbler—*Acanthopneuste davisoni*. (430).

Got a bird which I think was this and several moss nests containing tiny white eggs which I think must belong to it.

77. Yellow-bellied Flycatcher-Warbler—*Abnormis superciliaris*. (440).

A nest with 4 eggs, taken from a hole in a bamboo brought in with the parent bird in 1913.

78. Swinhoe's Reed-Warbler—*Urosphena squamiceps*. (457).

I shot a single specimen of this in December 1914, in thick jungle, playing about among the rocks in a small chaung forming the Burma Chin Hills boundary.

79. Brown Hill-Warbler—*Sitta crinigera*. (458).

80. Austen's Hill-Warbler—*Sitta khasiana*. (460).

81. Anderson's Hill-Warbler—*Suya superciliaris*. (461).

Nests of all these obtained. Numerous other small warblers were seen, which were not identified.

82. Indian Wren-Warbler—*Prinia inornata*. (466).

Shot a single specimen on low ground in March 1915.

83. Burmese Shrike—*Lanius collurioides*. (474).

Nests and eggs.

84. Black-headed Shrike—*Lanius nigriceps*. (475).

Nests and eggs.

85. Brown-Shrike—*Lanius cristatus*. (481).

Fairly common. One nest and eggs.

86. Nepalese Wood-Shrike—*Tephrodornis pelvius*. (486).

Shot a bird.

87. Burmese Scarlet Minivet—*Pericrocotus fraterculus*. (491).

88. Rosy Minivet—*Pericrocotus roseus*. (499).

89. Small Minivet—*Pericrocotus peregrinus*. (500).

90. Dark-grey Cuckoo-Shrike—*Campophaga melanoschista*. (505).

Found 2 nests with young, (May, 1913) and so did not shoot the parent birds.

91. Black-headed Cuckoo-Shrike—*Campophaga sykesi*. (508).

Shot a bird, low down.

92. Large Cuckoo-Shrike—*Graucalus macii*. (510).

Common.

93. Ashy Swallow-Shrike—*Artamus fuscus*. (512).

Common in clearings.

The Chins call this bird 'Pyalpya' which is their general name for swallows, martins and swifts.

94. Burmese Black-naped Oriole—*Oriolus tenuirostris*. (515).

Shot a bird at 3,000'.

95. Maroon Oriole—*Oriolus trailii*. (522).

Common. Got nests and eggs, exactly resembling those of the Common Oriole.

96. Indian Grackle—*Eulabee intermedia*. (524).

97. Grey-headed Myna—*Sturnia malabarica*. (538).

98. *Graculipica* sp. ?

I believe it is *burmanica*.

99. Common Myna—*Acridotheres tristis*. (549).

Mynas occur, but are not common.

100. Sooty Flycatcher—*Hemicheidon sibirica*. (558).
101. Little Pied Flycatcher—*Cyornis melanoleucus*. (569).
 A nest brought in with this bird, containing 4 eggs, measuring .68" x .54", of the same type as *C. rubeculoides* and *C. superciliosus*. Shot 2 or 3 birds, but did not manage to find a nest myself.
102. Blue-throated Flycatcher—*Cyornis rubeculoides*. (575).
 Common.
103. Verditer Flycatcher—*Stoparola melanops*. (579).
 Fairly common.
104. Sharpe's White-gorgeted Flycatcher—*Anthipes leucops*. (584).
 A bird brought with a nest, a very deep cup, placed in the grass growing from holes in a tree stump. Nest made of grass, leaves, and a little moss lined with fine grass fibres, a few bamboo leaves, and skeleton leaves being worked into the outside. The eggs were .69" x .53", and were white, spotted with reddish brown.
105. Grey-headed Flycatcher—*Culicicapa ceylonensis*. (592).
106. Large Niltava—*Niltava grandis*. (593).
107. Burmese Paradise Flycatcher—*Terpsiphone affinis*. (599).
 A nest and bird from the Chin Hills—Manipur boundary.
108. Indian Black-naped Flycatcher—*Hypothymis azurea*. (601).
109. White-browed Fantail Flycatcher—*Rhipidura albifrontata*. (604).
 Shot a bird low down. It changes higher up into the next species.
110. White-throated Fantail Flycatcher—*Rhipidura albicollis*. (605).
111. Common Pied Bush-Chat—*Pratincola caprata*. (608).
112. Harington's Bush-Chat—*Oreicola ferrea haringtoni*. (615 a).
 Not uncommon. The nest is built in a bank, often along a path, and is large for the size of the bird. It is a deep cup, made of moss, grass and grass roots, or of moss only, lined with fine grass bark-fibre, roots, and often goat's hair (or in one nest only, fine yellowish roots only). The sides and bottom of the nest are thick, and in two cases the nest was made entirely of moss. This was the only nest found in which hair was much used. The eggs are pale blue—almost "hedge-sparrow" blue—and have a series of faint reddish markings (spots, or speckles) round the large end of the eggs. These vary greatly, in some cases forming a distinct ring (in 2 eggs a cap) and in others being only seen with difficulty; in a few eggs, and in one whole clutch, they were entirely absent. Clutches generally numbered 4 or 5, but in one case I found 3 hard set eggs. Average size of 43 eggs is .72" x .56. Length from .67" to .78", and the breadth from .53" to .58.
113. Eastern Spotted Forktail—*Hemicurus guttatus*. (631).

114. Slaty-backed Forktail.—*Henicurus schistaceus*. (632).
 115. White-capped Redstart—*Chimarrhorns leucocephalus*. (638).
 116. Magpie Robin—*Copsychus saularis*. (663).
 117. Black-busted Ouzel—*Merula protomomelana*. (679).

Fairly common. The eggs and nests of the usual meruline type, the nest being made of moss lined with roots, and placed in a fork at no great height from the ground, or actually on the ground itself.

118. Orange-headed Ground-Thrush—*Geocichla citrina*. (686).
 119. Chestnut-bellied Rock-Thrush—*Petrophila erythrogaster*. (690).
 Shot a single specimen on the boundary in March.

120. *Zoothera* sp.?

Seen on the road. Could not identify it further.

121. *Cinclus* sp.?

Seen in the Nanpalaw stream.

122. Chestnut-bellied Munia—*Munia atricapilla*. (726).
 123. Hodgson's Munia—*Uroloncha acuticaudata*. (727).
 124. Cinnamon Tree-Sparrow—*Passer cinnamomeus*. (780).
 125. Indian Sand-Martin—*Cotile sinensis*. (809).

Seen in streams at low levels.

126. Eyke's Striated Swallow—*Hirundo erythropygia*. (828).

127. *Anthus* sp.?

I think it was *striolatus*.

128. *Alauda gulgula*?

These two species, of whose identification I am doubtful, were seen especially in the wind trap.

129. Larger Streaked Spider-hunter—*Arachnothera magna*. (906).

Two or 3 nests and birds.

130. Fire-breasted Flower-pecker—*Dicaeum ignipectus*. (915).

Shot 1915.

131. Green-breasted Pitta—*Pitta cucullata*. (935).

A clutch of 5 eggs and the parent bird brought in by a Chin in June 1915.

132. Gould's Broadbill—*Serilophus lunatus*. (942).

133. Hodgson's Broadbill—*Serilophus rubripygus*. (945).

134. Long-tailed Broadbill—*Parisomus dathousia*. (944).

135. Black-naped Green Woodpecker—*Geonurus occipitalis*. (950).

136. Small Himalayan Yellow-naped Woodpecker—*Gecinulus chlorolophus* (951).

137. Northern Pale-headed Woodpecker—*Gecinulus grantia*. (958).

138. Rufous-bellied Pied Woodpecker—*Hypopicus hyperythrus*. (960).

I am not quite satisfied with this identification, but think it is correct.

139. Stripe-breasted Pied Woodpecker—*Dendrocopus atratus*. (968).

140. Great Slaty Woodpecker—*Hemilophus pulverulentus*. (996).

141. Rufous Piculet—*Sasia ochracea*. (1002).

142. Great Himalayan Barbet—*Megalama marshallorum*. (1006).

143. Lineated Barbet—*Therasiceryx lineatus*. (1009).

144. Blue-throated Barbet—*Cyanops asiatica*. (1012).

145. Golden-throated Barbet—*Cyanops franklini*. (1017).

Nest and eggs, 1915.

146. Crimson-breasted Barbet—*Xantholæma hamatocephala*. (1019).

147. Burmese Roller—*Coracias affinis*. (1023).

148. Broad-billed Roller—*Eurystomus orientalis*. (1025).

149. Common Indian Bee-eater—*Merops viridis*. (1026).

This and the next 3 species all seen in a deep valley.

150. Blue-tailed Bee-eater—*Merops philippinus*. (1027).

151. Chestnut-headed Bee-eater—*Melittophagus swinhoii*. (1030).

152. Blue-bearded Bee-eater—*Nyctiornis athertoni*. (1031).

Nest and young, 1913. Nest and eggs, 1915.

153. Indian Pied Kingfisher—*Ceryle varia*. (1033).

154. Himalayan Pied Kingfisher. *Ceryle lugubris*. (1034).

I saw a large pied king-fisher, which I think must have been this.

155. Common Kingfisher—*Alcedo ispida*. (1035).

156. Blyth's Kingfisher—*Alcedo grandis*. (1038).

An *Alcedo* seen in the Nampalaw stream, not *A. ispida*. Identification not certain.

157. Brown-headed Stork-billed Kingfisher—*Pelargopsis gurial*. (1043).

158. White-breasted Kingfisher—*Halcyon myrnenensis*. (1044).

159. Great Hornbill—*Dichoceros bicornis*. (1051).

160. Indo-Burmese Pied Hornbill—*Anthracoceros albirostris*. (1053).

161. Malayan Wreathed Hornbill—*Rhytidoceros undulatus*. (1054).

All these are common. They are valued by the Ohins, as their feathers are much used both as ceremonial head dresses (as are the tail feathers of racket-tailed drongos) and for hanging round graves. The hornbill is the only bird of killing which a record is put on the grave; that is, the custom is to cut into a teak plank or stone used as the head piece of the grave an image of all beasts killed by the tenant (including things from men and elephants to barking deer), but hornbills are the only birds so recorded. They are shot from a platform in a ficus-bound tree, with a bow and arrow, when they come to feed.

162. Indian Hoopoe—*Upupa indica*. (1067).

163. Brown-necked Spine-tail—*Chætura indica*. (?) (1078).

I saw a flock one day which I think was this.

164. Common Indian Nightjar—*Caprimulgus asiaticus*. (1091).

165. Horsfield's Nightjar—*Caprimulgus macrurus*. (1093).

166. Chinese Nightjar—*Caprimulgus jotaka*. (1095 a).

Two hard set eggs taken at Haingyan, which were unfortunately broken.

167. Great Eared Nightjar—*Lyncornis cerviniceps*. (1096).

Saw this bird in the Chin Hills and took two eggs (both single) in the Upper Chindwin Division. They were found in 'Tin-wa' (*Cephalostachyum pergracile*) bamboo jungle, one on 2nd April 1914, very hard set, and measuring $1.69'' \times 1.18''$, the egg being an oval slightly pointed at one end, and the other on 15th April 1915, Fresh, a perfect oval measuring $1.66'' \times 1.17''$. In neither case was there any nest, and the eggs were of the usual nightjar type.

168. Hodgson's Frogmouth—*Batrachostomus hodgsoni*. (1097).

Six or seven nests brought in, one with young birds, four or five with eggs, and the rest empty. Typical of the species.

169. Red-headed Trogon—*Harpactes erythrocephalus*. (1101).

170. Red-rumped Trogon—*Harpactes duvauceli*. (1102).

Hopwood saw one in 1913, but was unfortunate in missing it. It was either this, or some species not included in F. B. I., as it was not *fasciatus*, *erythrocephalus* or *orencius*.

171. Cuckoo—*Cuculus canorus*. (1104).

Common.

Took eggs from nests of *M. argentauris*, pale blue and measuring $.92'' \times .71''$ and $.88'' \times .69''$.

172. Himalayan Cuckoo—*Cuculus saturatus*. (1105).

I took two eggs from nests of (?) *A. davisoni* which are exactly like those which this bird lays, but did not shoot a bird.

173. Large Hawk-Cuckoo—*Hierococcyx sparveroides*. (1108).

Common. I took eggs of this bird as follows:—

- (1) Ex. 130 (*P. maclellandi*) longish in shape; light blue, $1.29'' \times .83''$. Fresh, 24th April 1914; 3 eggs of *P. maclellandi*.
- (2) Ex. 79. (*I. cineracea*) rather more obtuse and darker than (1), Slightly set, $1.27'' \times .85''$. 2 eggs of *I. cineracea*, 28th April 1915.
- (3) Ex. 130. Hard set; shape as (2) but darker blue. $1.26'' \times .84''$ 2 eggs of No. 130, 28th April 1914.
- (4) Ex. 130. Like (1) $1.26'' \times .82''$, one egg of *P. maclellandi*, 24th April 1915.
- (5) Ex. 79. Hard set. Very obtuse. Colour between (1) and (2), $1.28'' \times .88''$. 2 eggs of No. 79, 3rd May 1915.

In addition to these, which are in my collection, Hopwood has 3 or 4 more, of which I have not got particulars, one ex. *G. pectoralis*, one ex. 79, and one ex. 130. A young bird was obtained in 1914 in the nest of *M. argentauris*; and a bird was seen to get up off the path with something in its mouth; I think it was an egg, but could not shoot the bird to make sure.

174. Common Hawk-Cuckoo—*Hierococcyx varius*. (1109).

Two eggs, both from the nests of *I. cineracea*, the first a light, the second a deepish blue, $1.01'' \times .82''$, and $1.02'' \times .80''$, were referred to this species.

175. Hodgson's Hawk-Cuckoo—*Hierococcyx nasicolor*. (1110).

Two eggs from nest of *C. rubeculoides*, $.84'' \times .57''$, and $.93'' \times .65''$.

176. Drongo Cuckoo—*Surniculus lugubris*. (1117).

I found a nest of *B. remifer* containing 3 eggs, left it for 2 days, and sent out a man to bring it in. It then contained only two of the original eggs, and a third which I think may be that of this species, which had not been there before. It seems too big for the bird, being $1.03'' \times .79''$, but I do not think the man sent out to bring in the nest is likely to have played any tricks and do not know what else it can be.

177. Indian Koel—*Eudynamis honorata*. (1120).

178. Large Green-billed Malkoha—*Rhopodytes tristis*. (1123).

179. Large Burmese Paroquet—*Palæornis indoburmanicus*. (1136).

180. Rose-ringed Paroquet—*Palæornis torquatus*. (1138).

181. Burmese Slaty-headed Paroquet—*Palæornis finschi*. (1142).

182. Red-breasted Paroquet—*Palæornis fasciatus*. (1145).

183. Screech Owl—*Strix flammea*. (1152).

Heard one evening.

184. Brown Fish-Owl—*Ketupa zeylonensis*. (1164).

185. Large-Barred Owllet—*Glaucidium cuculoides*. (1183).

186. Jungle Owlet—*Glaucidium radiatum*. (1184).

Shot a bird at 1,500' which I identified as this. It was badly smashed up.

187. Brown Hawk-Owl—*Ninox scutulata*. (1187).

188. Indian White-backed Vulture—*Pseudogyps bengalensis*. (1196).

189. Black Eagle—*Ictinaetus malayensis*. (1210).

190. Changeable Hawk Eagle—*Spizaetus limnaetus*. (1212).

191. Crested Serpent Eagle—*Spilornis cheela*. (1217).

Bird off the nest, which was about half way up a 600' hill at about 4,000', and made of sticks with a lining of green leaves. It was placed about 30' up in the fork of a 60' tree, the nest contained one egg, set, 2'75" x 2'12". The tail and wing feathers of this, and all the big hawks and eagles are much prized by the Chins for ceremonial observances. They pay up to two annas each for them.

192. Pariah Kite—*Milvus govinda*. (1229).

193. Shikra—*Astur badius*. (1244).

194. Crested Goshawk—*Lophopizias trivirgatus*. (1246).

195. Besra Sparrow-Hawk—*Accipiter virgatus*. (1248).

196. Crested Honey-Buzzard—*Pernis ptilorhynchus*. (1249).

197. Shahin Falcon—*Falco peregrinator*. (1255).

198. Red-legged Falconet—*Microhierax eulomus*. (1267).

I saw several other hawks and eagles which I could not recognise.

199. Bengal Green Pigeon—*Crocopus phaeocephalus*. (1271).

200. Thick-billed Green Pigeon—*Treron nepalensis*. (1281).

Nest at Madan in 1913.

201. Pin-tailed Green Pigeon—*Sphenocercus apicauda*. (1282).

Several nests and birds.

202. Green Imperial Pigeon—*Carpophaga aenea*. (1284).

Shot a bird at a low elevation. The next species is found higher up.

203. Grey-headed Imperial Pigeon—*Ducula griseicapilla*. (1287).

204. Bronze-winged Dove—*Chalcophaps indica*. (1291).

205. Indian Turtle-Dove—*Turtur ferrago*. (1305).

206. Malayan Spotted Dove—*Turtur tigrinus*. (1308).

207. Bar-tailed Cuckoo Dove—*Macropygia tusalia*. (1312).

Many nests and eggs. Nest massive for a dove, having often some moss mixed with the twigs. Only twice got two eggs.

or young birds in one nest, the rest were all single. Hopwood kept a bird snared off a nest for 6 months; it did very well on a diet of rice, but died in the rains.

208. Red Jungle Fowl—*Gallus ferrugineus*. (1328).

209. Mrs. Hume's Pheasant—*Phasianus humie*. (1331).

Eggs, with a bird skin. The eggs were of the ordinary *Phasianus* type; 3 clutches were obtained, all from about 6,500'. The bird seems to breed near the top of the main ridge. 8 eggs obtained on 1st May 1914, Hard set; 7 eggs on 1st May 1914, Hard set; 10 eggs on 1st May 1915, Hard set. The average size of 15 eggs is 1.85" x 1.37". Length from 1.99" to 1.78", and breadth from 1.31" to 1.40".

210. Black-breasted Kalij Pheasant—*Gennæus horsfieldi horsfieldi*. (1339).

211. Cuvier's Silver Pheasant—*Gennæus h. cuvieri*. (1340 d).

212. Williams's Silver Pheasant—*Gennæus h. williamsi*. (1340 c).

I was much puzzled by the variation in the pheasants, until I saw Mr. E. C. Stuart-Baker's paper (J. B. N. H. S., Vol. XXIII, p. 662), showing that these three sub-species all occur in a very narrow area, all three falling within the area worked by us.

213. Grey-bellied Horned Pheasant—*Tragopan blythii*. (1346).

A female snared and brought in in 1913, eggs not obtained.

214. Western Bamboo-Partridge—*Bambusicola fytchii*. (1352).

Common.

215. Arrakan Hill-Partridge—*Arboricola intermedia*. (1364).

216. White-cheeked Hill-Partridge—*Arboricola atrigularis*. (1365).

As far as I could make out, *A. intermedia* was the form in the West, *A. atrigularis* in the East. But there was a great deal of overlapping.

217. Chinese Francolin—*Francolinus chinensis*. (1374).

Eggs and bird obtained in 1914.

218. Woodcock—*Scolopax rusticola*. (1482).

Undoubtedly occurs in the winter, and might remain to breed. We found none.

219. Great White-bellied Heron—*Ardea insignis*. (1557).

Several herons, etc., were met with in the streams at the foot of the hills. This was the only one identified.

A CATALOGUE OF NEW WASPS AND BEES (*FOSSORES*,
DIPLOPTERA AND *ANTHOPHILA*) DESCRIBED FROM
 THE INDIAN REGION SINCE 1897.

BY

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PART III.

(Continued from page 721 of Volume XXIV.)

DIPLOPTERA.

MEGACHILE.

- M. sycophanta*, Cameron, p. 131, Mem. Manch. Soc. XLI (4), 1897,
 Missouri.
- M. impicator*, Cameron, p. 132, do. do. do.
- M. maligna*, Cameron, p. 133, do. do. do.
- M. parvula*, Cameron, p. 135, Mem. Manch. Soc., XLI (4), 1897 do.
- M. chrysogaster*, Cameron, p. 136 do. do. do.
- M. nigricans*, Cameron, p. 75, Mem. Manch. Soc., XLII (11), 1898, Ceylon.
- M. erusta*, Bingham, p. 125, B.J., XII, Deesa.
- M. coctioryoides*, ♀, Bingham, p. 126, B.J., XII.
- Do. ♂, Nurse, p. 150, J.A.S.B., LXX, 1902, Deesa.
- Do. Cameron, p. 852, B.J., XVIII, 1908.
- M. studiosa*, Bingham, p. 126, B.J., XII, 1898.
- M. studiosella*, Cockerell, p. 314, A.M.N.H., VII, 1911, Simla.
- M. vera*, Nurse, p. 150, J.A.S.B., LXX, 1901, Deesa.
- M. katinka*, Nurse, p. 150, do. do. Matheran.
- M. patella*, Nurse, p. 151, do. do. Simla.
- M. ulrica*, Nurse, p. 151, do. do. Matheran.
- M. otrialea*, Cameron, p. 60, Fauna Mald., I, 1902, Maldives.
- M. cinerascens*, Cameron, p. 61, do. do. Laccadives.
- M. nuda*, Nurse, p. 546, A.M.N.H., XI, 1903, Murree.
- M. appia*, Nurse, p. 546, do. do. Kashmir.
- M. sodan*, Friese, p. 245, Zeits. Hym. Dipt. III, 1903, Khasia hills.
- M. melocera*, Friese, p. 358, do. do. do.
- M. himalaia*, Cameron, p. 216, A.M.N.H., XIII, 1904 do.
- M. hypoleuca*, Cameron, p. 15, Zeit. Hym. Dipt., IV, 1904, Ceylon.
- M. abnormis*, Friese, p. 329, do. do. Nicobars.
- M. andrea*, Muhl. Nurse, p. 574, B.J., XX, 1904, Baluchistan.
- M. opima*, Spin., do. do. do. do.
- M. robusta*, Fabr., do. do. do. do.
- M. aspericornis*, Mör., do. do. do. do.
- M. muraria*, Latr., do. do. do. do.
- M. phoca*, Cameron, p. 1005, B.J., XVII, 1907, Deesa.

M. lefroma, Cameron, p. 1006, B. J., XVII, 1907, Matheran.

Same as *M. saphira*, (below) Meade Waldo, p. 403, A. M. N. H., XIV, 1914.

M. saphira, Cameron, p. 1006, B. J., XVII, 1907, Matheran.

M. devdatta, Cockerell, p. 224, Bull. Amer. Mus., 1907, India.

M. gathela, Cameron, p. 650, B. J., XVIII, 1908, Deesa.

Same as *M. nana*, Bingham, 1897—Meade Waldo, p. 403, A. M. N. H., XIV, 1914.

† *M. bombayensis*, Cameron, p. 650, B. J., XVIII, 1908, Bombay.

M. lissopoda, Cameron, p. 651, do. do. do.

M. cathena, Cameron, p. 651, do. do. do.

M. cratodonta, Cameron, p. 652, do. do. Deesa.

M. subfuscus, (Nurse—Ms.), Cameron, p. 652, B. J., XVIII, 1908, Matheran.

M. indostana, Cameron, p. 653, B. J., XVIII, 1908, Deesa.

M. rugicauda, Cameron, p. 653, do. do. do.

Same as *M. patellimana*, Spin, (1838)—Meade Waldo, p. 403, A. M. N. H., XIV, 1914.

M. lerna, (Nurse—Ms.), Cameron, p. 654, B. J., XVIII, 1908, Matheran.

Same as *M. Umbripenis*, Smith, (1853)—Meade Waldo, p. 403, A. M. N. H., XIV, 1914.

M. leptodonta, Cameron, p. 654, B. J., XVIII, 1908, Deesa.

† *M. erythrostoma*, Cameron, p. 655, do. do.

M. suarida, Cameron, p. 655, do. do.

M. nicevillei, Cameron, p. 41, Entomologist, 1908, India.

M. obtusata, Cameron, p. 51, D. Ent. Z., 1909, Ferozepur.

M. striolata, Cameron, p. 131, B. J., XIX, 1909, Simla.

M. heterotrichia, Cameron, p. 132, do. do.

M. semireticulata, Cameron, p. 132, do. Ferozepur.

M. ferozepurensis, Cameron, p. 133, do. do.

M. Simlaensis, Cameron, p. 133, do. Simla.

M. melanoneura, Cameron, p. 134, do. do.

Same as *M. maritima*, K. (1802)—Meade Waldo, p. 403, A. M. N. H., XIV, 1914.

M. inepta, Cameron, p. 135, B. J., XIX, 1909, Simla.

M. punjabensis, Cameron, p. 135, B. J., XIX, 1909, Ferozepur.

M. mystacea, F. Notes on—Bingham, p. 183, T. Z. S., 1909.

M. funehriicornis, Strand, p. 38, Jahr. Ver. Wies., 63, 1910, Ceylon.

M. ladacensis, Cockerell, p. 252, Proc. U. S. Nt., Mus., 40, 1911, Ladak.

M. rupshuensis, Cockerell, p. 253, do. do. do.

M. faceta, Bingham, Cockerell, p. 315, A. M. N. H., VII, 1911, Khasia.

M. caroli.

M. Ceylonensis, Bingham, ♀, p. 482, F. B. I., I, 1897, Ceylon.

M. caroli, Meade Waldo, p. 464, A. M. N. H., X, 1912.

(wrongly put as *Ceylonica* in Bingham's, F. B. I.)

M. stulta, Bingham. Notes on—Meade Waldo, p. 464, A. M. N. H., X, 1912.

M. binghami.

M. bellula, Bingham, ♂, p. 476, F. B. I., I, 1897.

M. binghami, (new name) Meade Waldo, p. 465, A. M. N. H., X, 1912.

M. luculenta, Bingham; (a distinct sp. not same as *M. Mystacea*, see p. 479 of Bingham's, F. B. I., i, 1897)—Meade Waldo, p. 466, A. M. N. H., X, 1912.

M. semivestita, Smith. ♂, Meade Waldo, p. 467, do. do. (is the ♂, of

M. Determinat Smitha, ♀ —Meade Waldo.)

† These two are the same as *M. hera*, Bingham (1897)—Meade Waldo, p. 465, A. M. N. H., XIV, 1914.

M. atrata.*M. atrata*, Smith, ♀, p. 182, Cat. I.*M. viriplacea*, Cam., ♂ (1902).*M. shelfordi*, Cam., ♀ (1902).*M. atrata*, Meade Waldo, p. 467, A. M. N. H., X, 1912.M. velutina.*M. velutina*, Smith Cat., I, p. 180, ♀.*M. Dimidiata*, Smith Cat., p. 174, ♀.*M. velutina*, Meade Waldo, p. 468, A. M. N. H., X, 1912.*M. habropodoides*, Meade Waldo, p. 472, A. M. N. H., X, 1912, Sikkim.*M. striostoma*, Cameron, p. 28, Ind. For. Rec., IV, (2), 1913, Dehra Dun.*M. albifrons*, Smith, Food habits of—Burkill, p. 102, J.A.S.B., VI, 1911.*M. disjuncta* and *parevaspis abdominalis*. Distinctions—Bingham, p. 58,

B. J., XII, 1898.

AGLAOPIS (gen. nov. 1901).

A. brevipennis, Cameron, p. 263, Entomologist, XXXIV, 1901, Bombay.

(This is a typical Dioxy's Lepel—Meade Waldo, p. 496, A. M. N. H., XII, 1913.)

PAREVASPIS.

P. carbonaria, Smith.—Meade Waldo, p. 227, A. M. N. H., VII, 1911.

EUASPIS.

E. smithi.*Parevaspis abdominalis*, Smith, p. 79, Journ. Linn. Soc., 1859, ♂.*Euaspi smithi*, Friese, p. 137, Allg. Zeit. Ent., IX, 1904.

ANTHIDIUM.

A. flaviventre, Cameron, p. 124, Mem. Manch. Soc., XII (4), 1897, Poona.*A. desicionum*, Bingham, p. 126, pl. A., fig. 12, B. J., XII, 1898, Deesa.*A. bingami*.*A. raternum*, Bingham, p. 496, F. B. I., I, 1897.*A. bingami* (nov. name), Friese, p. 224, Zeit. Hym. Dipt., I., 1901.*A. satillator*, Nurse, p. 151, J. A. S. B., LXX, 1902, Deesa.

Do. do. p. 575, B. J., XV, 1904.

A. nasicum, Nurse, p. 152, J. A. S. B., LXX, 1902, Matheran.*A. conciliatum*, Nurse, p. 547, A. M. N. H., XI, 1903, Kashmir.*A. floratum*, Fabr.**A. fedtschenkoi*, Mor.* } Nurse, p. 575, B. J., 1904, Quetta.*A. pallidum*, Cockerell, p. 242, Entomologist, 1910, Himalaya.*A. teresatum*, Cockerell, p. 181, A. M. N. H., VIII, 1911, Quetta.*A. pallidum atoti*, var. nov., Cockerell, p. 249, Proc. U. S. Nat. Mus., 1911, Ladak.

DIANTHIDIUM.

D. castaneum, Cockerell, p. 179, A. M. N. H., VIII, 1911, Karachee.*D. rufum*.*D. rufum rufum*, Smith, p. 50, T. E. S., 1875.*D. rufum*, Cockerell, p. 180, A. M. N. H., VIII, 1911.*Anthidium* and *Dianthidium*—Composition—Cockerell, p. 136, A. M. N. H., VI, 1902.

PROANTHIDIUM.

P. soliferum, Cockerell, p. 180, A. M. N. H., VIII, 1911, Karachee.

CAMPTOPOEUM.

C. rufiventre, * Mor.

c. schewyrewi, Mor^p—Nurse, p. 575, B. J., XV, 1904, Quetta.

CEBATINA.

C. ornatifera, Cameron, p. 141, Mem. Manch. Soc., XII, (4), 1897. Missouri.

C. incognita, Bingham, p. 127, B. J., XII, 1898. Simla.

C. muscatella, Nurse, p. 152, J. A. S. B., LXX, 1902. do.

C. loquata, Nurse, p. 153, do. do. do.

C. ino, Nurse, p. 575, B. J., XV, 1904, Quetta.

C. egeria, Nurse, p. 576, do. do. do.

C. corinna, Nurse, p. 576, do. do. do.

C. laevifrons, Mor.* noted by Nurse, p. 577, do. do.

C. binghami, Cockerell, p. 340, A. M. N. H., I, 1908, Calcutta.

Do. do. p. 185, A. M. N. H., 1911.

C. eburneopicta, Cockerell, p. 185, A. M. N. H., VIII, 1911, Salsetta.

C. comberi, Cockerell, p. 185, do. do. Karachee.

C. bhawani, (new form), Bingham, p. 360. Rec. Ind. Mus., I, 1908.

Ceratina—Notes on—Cockerell, and Porter, pp. 404–406, A. M. N. H., IV, 1899.

NOMOIDES.

N. appendiculata.

Ceratina appendiculata, Cameron, p. 59, Fauna Mald., I, 1902, Maldives.

Nomoides do. Cockerell, p. 312, A. M. N. H., 1909.

N. karachensis, Cockerell, p. 235, A. M. N. H., VII, 1911, Karachee.

N. comberi, Cockerell, p. 236, do. do. do.

= *Ceratina punjabensis*, Cam., p. 1003, B. J., XVII, 1907.

= *N. comberi*, Meade Waldo, p. 403, A. M. N. H., XIV, 1914.

N. divisa.

Ceratina divisa, Cameron, p. 1003, B. J., XVII, 1907, Quetta.

Ceratina spilaspis, Cameron, p. 657, B. J., XVIII, 1908, Deesa.

Nomoides cerea.

Ceratina cerea, Nurse, p. 152, J. A. S. B., LXX, 1902, Deesa.

Nomoides cerea, Meade Waldo, p. 495, A. M. N. H., XI, 1913.

Nomoides curvilinearata.

Ceratina curvilinearata, Cameron, p. 1004, B. J., XVII, 1907, Deesa.

Nomoides curvilinearata, Meade Waldo, p. 495, A. M. N. H., XII, 1913.

Nomoides—Taxonomy, Cockerell, p. 236, A. M. N. H., VII, 1911.

ALLODAPE.

A. pictitarsis, Cameron, p. 60, Fauna Mald., I, 1902, Laccadives.

A. pumilio, Cockerell, p. 182, A. M. N. H., VIII, 1911, Karachee.

HERIADES.

(Eriades, Friese).

E. tenuis Nurse, p. 577, B. J., XV, 1904, Mt. Abu.

* New to the region.

CELIOXYS.

- C. taurus*, Nurse, p. 153, J. A. S. B., LXX, 1902, Deesa.
C. stolidus, Nurse, p. 548, A. M. N. H., XI, 1903, do.
C. cariniscutis, Cameron, p. 213, A. M. N. H., XIII, 1904, Khasia Hills.
C. khasiana, Cameron, p. 213, do. do. do.
C. latus, Cameron, p. 653, B. J., XVIII, 1908, Matheran.
C. turneri, Cockerell, p. 418, A. M. N. H., V, 1910, Assam.
C. sulcispinus, Cameron, p. 29, Ind. For. Rec., IV, 2, 1913, Dehra Dun.
C. fulvitaris, Cameron, p. 30, do. do. Missouri.
C. tenuilineata, Cameron, p. 31, do. do. Simla.
 Same as *C. confusa*, Smith (1875), Meade Waldo, p. 404, A. M. N. H., XIV, 1914.
C. fuscipes, Cameron, p. 31, Ind. For. Rec., IV, 2, 1913, Simla.
C. ruficaudis, Cameron, p. 32, do. do. do.
 Same as *C. afra*, Lep. (1841), Meade Waldo, p. 404, A. M. N. H., XIV, 1914.
 Ceratina species; Cockerell, pp. 85-90, Psyche, XII, 1905.

CROCISA.

- C. ramosa* Lepel—Sleeping—Green, p. 214, Ent. Mag., 1899.
C. kashmirensis, Nurse, p. 548, A. M. N. H., XI, 1903, Kashmir.
C. elegans, Mor.* Nurse, p. 578, B. J., XV, 1904, Quetta.
C. ceylonica, Friese, p. 4, Zeit. Hym. Dipt., V, 1905, Ceylon.
C. rostrata, Friese, p. 6, do. do. Simla.
 Crocisa—Table of Indo-Australian species of—Friese, pp. 2-12, Zts. Hym. Dipt., V., 1905.

PODALIRIUS.

- P. vedettus*, Nurse, p. 582, B. J., XV, 1904, Kashmir.
P. connerus, Nurse, p. 583, do do. Quetta.
P. sergius, Nurse, p. 584, do. do. do.
P. picicornis, Fedt.*
P. albigenus, Lap.*
P. orientalis, Mor.*
P. fulvitaris, Brulle* Nurse, p. 585, B. J., XV, Quetta.
P. atricollis, Ever.*
P. velocissimus, Fedt.*
P. khasianus.
Habropoda fulvipes, Cameron, p. 211, A. M. N. H., XIII, 1904.
Podalirius khasianus, Schulz., p. 253, Spol. Hym., 1906, Khasia Hills.
P. binghami.
Anthophora crocea, Bingham, p. 526, F. B. I., I, 1897.
Podalirius binghami, Schulz., p. 253, Spol. Hym., 1906.
P. wickhami, Bingham, p. 122, Spol. Zeyl., V., 1908, Ceylon.

TETRALONIA.

- T. punctata*, Cameron, p. 79, Mem. Manch. Soc., XLII (11), 1898, Poona.
T. brevipennis, Cameron, p. 78, Mem. Manch. Soc., XLII (11), 1898, Allahabad.
 Characters of *T. brevipennis* Cam.—Nurse, p. 549, A. M. N. H., XI, 1903.

* New to the region.

- T. ovatula*, Cameron, p. 649, B. J., XVIII, 1908, Deesa.
T. glabriocornis, Cameron, p. 649, do. do.
T. pruinosa, Cameron, p. 47, D. Ent. Z., 1909, Ferozepur.
T. punctilabris, Cameron, p. 48, do. do.
T. testaceitarsis, Cameron, p. 49, do. do.
T. erythroceras, Cameron, p. 49, D. Ent. Z., 1908, do.
T. Punjabensis, Cameron, p. 49, do. do.
T. rufolineata, Cameron, p. 50, do. do.
T. claripennis, Cameron, p. 51, do. do.
T. leucopoda, Cockerell, p. 183, A. M. N. H., VIII, 1911, Nasik.
T. commixtana, Strand, p. 146, Archives Naturges, 79A, 1913, Ceylon.
T. taprobanicola, Strand, p. 147, do. do.
Tetralonia and Melissodes.—Comparison of generic characters—Cameron, p. 76, Mem. Manch. Soc., XLII (11), 1898.

TETRALONIELLA.

- T. aliena*, Cockerell, p. 184, A. M. N. H., VIII, 1911, Nasik.
T. calidula, Cockerell, p. 34, Entomologist, 1913, Salsette.

EUCEREA.

- E. medusa*, Nurse, p. 578, B. J., XV, 1904, Quetta.
E. diana, Nurse, p. 579, do. Kashmir.
E. phryne, Nurse, p. 579, do. Deesa.
E. pomona, Nurse, p. 580, do. Quetta.
E. cassandra, Nurse, p. 581, do. do.
E. melanostoma, Mor.*, Nurse, p. 579, do. do.
E. spectabilis, Mor.*, Nurse, p. 582, do. do.
E. turcestanica, Dalla Torre.*Nurse, p. 582, do. do.
Eucerinae—List of spp. Cockerell, pp. 261-273, Proc. N. 5, Nat. Mus., 1912.

HABROPODA.

- H. krishna* (form nov.), Bingham, p. 366, Rec. Ind. Mus., 1908, Darjiling.
H. turneri, Cockerell, p. 308, Entomologist, 1909, Assam.

ANTHOPHORA.

- A. deiopaea*, Cameron, p. 127, Mem. Manch. Soc., XLI (4), 1897, Missouri.
A. rothmeyei, Cameron, p. 142, do. do. do.
A. cellularis, Cameron, p. 80, Mem. Manch. Soc., XLII (11), 1898, Poona.
A. liriopae, Bingham, p. 127, B. J., XII, 1898, Deesa.
A. iole, Bingham, p. 128, do. do. Simla.
A. antiope, Bingham, p. 128, do. do. do.
A. zonata, L., varieties; Cockerell, p. 411, A. M. N. H., V, 1910, Dehra Dun.
A. zonata var. *puttalama*, Strand., p. 147, Archives Naturges, 79 A, 1913 Puttalam (Ceylon).
A. cingulifera.
A. cingulata, Fab. Bingham, p. 526, F. B. I., i, 1897.
A. cingulifera, Cockerell, p. 410, A. M. N. H., V, 1910, Dehra Dun.
(The true 'cingulata' according to Cockerell is a different species and Australian).
A. megarrhina, Cockerell, p. 413, A. M. N. H., V, 1910, Sikkim.
A. do. var. *soluta*, Cockerell, p. 414, A. M. N. H., V, 1910, Sikkim.

* New to the region.

- A. khambana*, Cockerell, p. 415, A. M. N. H., V, 1910, Sikkim.
A. pulcherrima, Bingham, (var a), Cockerell, p. 413, A. M. N. H., V, 1910, Sikkim.
A. orophila, Cockerell, p. 415, A. M. N. H., V, 1910, Sikkim.
A. delicta, Cockerell, p. 235, Entomologist, 1911, India.
A. amolita, Cockerell, p. 237, do. do. do.
A. comberi, Cockerell, p. 493, A. M. N. H., VII, 1911, Nasik.
The homing of burrowing bees (Anthophoridæ)—Turner, p. 247, Biol. Bull., XV, 1908.
Anthophora and Melecta—relations—Johnson, p. 427, Zoologist, 1913.

ANTHRENA.

- A. brunneipennis*, (form new), Bingham, p. 362, Ind. Mus. Rec., II, 1908.
A. burkelli (form new), Bingham, p. 363, do. do. do.

XYLOCOPA.

- X. ceylonica*, Cameron, p. 32, P. Z. S., Pt. II, 1901, Ceylon.
X. tranquebarica, Fabr*—Schulz, p. 273, Zt. Hym. Dipt., 1901.
X. esica, Cameron, p. 61, Fauna Mald., i, 1902, Maldives.
X. gardineri, Cameron, p. 62, do. do. do.
X. amethystina, signiana—(new sub sp.), Cockerell, p. 310, A. M. N. H., VII, 1911.
X. collaris, Lepel, var binghami, Cockerell, p. 30, A. M. N. H., XIV, 1904.
X. minor, Maidl., p. 250, Ann. Nat. Hist. Hof. Wien, 1912, Sikkim.
X. amethystina, sigiriana—(new sub sp.), Cockerell, p. 310, A.M.N.H., VII, 1911, Sigiri, N. W. India.
X. madurensis, Friese, p. 88, D. Ent. Z., 1913, Madura.
Xylocopa and acarid pouch—Green, p. 232, Ent. Mag., 1902.

BOMBUS.

- B. gilgitensis*, Cockerell, p. 223, A.M.N.H., XVI, 1905, Kashmir.
B. waltoni, Cockerell, p. 239, Entomologist, 1910, Himalaya.
B. haemorrhoidalis, Smith—Habits—Burkill, p. 521, J.A.S.B., 1906.
Bombus Habits of Psithyrus and—Sladen, p. 30, Ent. Mag., 1899.
Hovering of Bombus—Saunders, p. 83, Ent. Mag., 1909.

APIS.

- A. nurei*.
A. testacea, Bingham, p. 129, B.J., XII, 1898, Deesa.
A. nurei, Cockerell, p. 319, A.M.N.H., VII, 1911.
A. florea and *dorsata*—combs., Friese, p. 193, Allg. Zeit. Ent., VII, 1902.
A. dorsata and *indica*—Habits—Hooker Agricultural Ledger, 1904, (Calcutta).
A. dorsata—Its domestication—Harris, p. 12, Ent. Record, XIV, 1902.
A. dorsata—Working hours—Burkill, p. 105, J.A.S.B., 1911.
A. dorsata—Friese, p. 273, Ann. Mus. Hung. 7, 1909.
A. florea sub. sp., nasicana, Cockerell, p. 241, Tr. Amer. Ent. Soc., XXXVII, 1911.
Apis—species and distribution—Enderlein, p. 331, Stett. Ent. Zt., 1906.
New generic names—'Megapis' and 'Micrapis'—for *dorsata* and *florea*—Ashmead, pp. 120-122, Proc. Ent. Soc., Washington, VI, 1904.
Apis—specific characters—Cockerell, p. 177, Entomologist, XXXVI, 1903.

* Newly recorded.

MELIPONA.

- M. cacciae*, Nurse, p. 619, B. J., XVII, 1907, Hoshangabad.
 Melipona—Nests and habits of, Schulz., p. 250, Zt. Insbiol, I, 1905.
 Trigona—Nests of—Waterhouse, p. 133, T. E. S., 1903.

DASYPODA.

- D. comberi*, Cockerell, p. 226, A. M. N. H., VII, 1911, Karachee.

MELITTA.

- M. altissima*, Cockerell, p. 240, Entomologist, 1910, Himalaya.

LAMPROAPIS.

- L. maculipennis*, Cameron, p. 420, pl. fig. 2, B. J., XIV, 1902, Simla.

EPEOLUS.

- E. fervidus*, Smith, recorded as from India before 1897, but not in Bingham.

- E. fervidus*, Smith, Cockerell, p. 668, A. M. N. H., VIII, 1911.
E. pictus, Nyl.*, Nurse, p. 570, B. J., XV, 1904, Quetta.
E. peregrinus, Cockerell, p. 234, A. M. N. H., VII, 1911, Nasik.
Do. do. do. p. 668, do. VIII, 1911.
E. assamensis, Meade Waldo, p. 94, A. M. N. H., XII, 1913, Assam.
E. tibetanus, Meade Waldo, p. 95, do. do. Tibet.

PLESIOPANURGUS (*gen. nov.* 1907).

- P. cinerarius*, Cameron, p. 131, B. J., XVIII, 1907, Quetta.

THYGATINA (*gen. nov.* Cockerell, 1911).

- T. fumida*, Cockerell, p. 237, Trans. Amer. Ent. Soc. (37), 1911, Ceylon.

MELISSINA (*gen. nov.* Cockerell).

- M. viator*, Cockerell, p. 670, A. M. N. H., VIII, 1911, Karachee.

TRINCHOSTOMA.

- T. sladeni*, Cockerell, p. 35, Cand. Ent., 1913, Khasia Hills.

CTENOAPIS (*gen. nov.* Cameron, 1901).

- C. lutea*, Cameron, p. 117, A. M. N. H., VIII, 1901, Ferozepur.
C. flavomaculata, Cameron, p. 117, do. do. do.
 Sexes of *C. lutea*, Nurse, p. 570, B. J., XV, 1904 (*lutea* ♀ and *flavomaculata* ♂).

MELANAPIS.

- M. violaceipennis*, Cameron, p. 421, pl. fig., B. J., XIV, 1902, Ferozepur.
M. rufifrons, Nurse, p. 567, B. J., XV, 1904, Quetta.

AMMOBATES.

- A. solitarius*, Nurse, p. 570, B. J., XV, 1904, Quetta.

PASITES.

- P. maculatus*, Jur, noted by Nurse, p. 570, B. J., 1904, Quetta.
 In addition to the numerous papers of Cameron, Bingham, Nurse, Meade, Waldo, Cockerell, Turner, etc., often quoted in the body of the catalogue,

* New to the region.

the following may be added as recent papers on Indian Aculeates in general :—

Aculeate Hymenoptera of Barrackpore—Rothney, pp. 93-116, T. E. S., 1903.

Life histories of Indian Hymenoptera—G. R. Dutt, Mem. Deptt. Agri. India, Ent. Series, Vol. IV, 1912. (a)

Hymenoptera of the Abor Country—Nurse and Paiva, Rec. Ind. Mus., Vol. VIII, Pts. I—V., 1912-1914. (b)

Hymenoptera from the Himalayas—Paiva, Rec. Ind. Mus., Vol. I., 1907.

The following supplementary list includes some new species recorded from the Indian region since the above list was prepared. A few references to already known species, some of which were overlooked by me before, are also added here :—

MUTILLIDÆ.

Mutilla.

Andre in his paper on Ceylon mutillids has referred to the following species in addition to the new forms noted above (see p. 544), in the D. Ent. Zs., 1907 :—

M. sorror, Sauss., p. 253.

M. insularis, Cam., p. 253.

M. humbertiana, Sauss., p. 255.

M. bicinota, Sauss., p. 255.

M. liliputiana, Andre, p. 256.

M. ocellata, Sauss., p. 256.

M. heraops, Sauss., p. 256.

M. acidalia, Cam., p. 256 (see p. 542 above).

M. analis, Lepel, p. 257.

M. indostana, Smith, p. 257.

M. foveata, Cam., p. 257 (see p. 544 above).

THYNNIDÆ.

Methoca.

Methoca bicolor, Cam., name changed to *M. rufonigra*, Dutt, p. 186, Mem. Deptt. Agri. India, Vol. IV, 1912.

BETHYLIDÆ.

PRISTOCERA (Klug).

P. cironeformis, Turner, p. 245, A.M.N.H., XIV, 1914, Pattikonda, S. India.

SCOLIIDÆ.

ELIS (Mesa).

E. crassipunctata, Turner, p. 246, A.M.N.H., 1914, Coimbatore, S. India.

(a) Contains interesting notes on habits and life histories of a number of aculeates.

(b) Contains chiefly references to known forms.

POMPILIDÆ.

PSAMMOCHARES.

P. nudatus.*

Pompilus nudatus, Sm., Cat., p. 133, 1855 (Trebizond).

Pompilus cassius, Nurse, p. 84, B. J., XIV, 1902 (see p. 549 above).

Pompilus horatius, Nurse, do. do. do.

Psammochares nudatus, Turner, p. 247, A.M.N.H., XIV, 1914 (Coimbatore).

P. detectus.

Pompilus reflexus, Bingham, p. 159, F.B.I., i., 1897 (nec., Smith), Sikkim.

Psammochares detectus, Turner, p. 248, A.M.N.H., XIV, 1914, Palur, S. India.

RHOPALOSOMIDÆ.

RHOPALOSOMA.

Rhopalosoma—Early stages of a sp., Hood, p. 145, Proc. Ent. Soc., Wash. Vol. XV, 1913.

SPHEGIDÆ.

AMPULEX.

A. pilosa, Cam.—Turner, p. 250, A.M.N.H., XIV, 1914 (see p. 555 above).

CHLOBION (SPHEX—HARPACTOPUS).

C. subfuscatus, Dahlb.,* Turner, p. 250, A.M.N.H., XIV, 1914, Coimbatore.

GORYTES.

G. cœrulescens, Turner, p. 251, A.M.N.H., XIV, 1914, Kandy, Ceylon.

NYSSON.

N. excavatus, Turner, p. 253, A.M.N.H., XIV, 1914, Coimbatore.

N. decoratus, Turner, p. 254, do. do. do.

N. dubitatus, Turner, p. 255, do. do. do.

N. basalis, Smith, Turner, p. 254, do. do. do.

PARAPIAGETIA, (Kohl.)*

P. wickwari, Turner, p. 256, A.M.N.H., XIV, 1914, Colombo, Ceylon.

LYRODA.

L. nigra.

Odontolarra nigra, Cam. (see p. 553 above).

Lyroda nigra, Turner, p. 256, A.M.N.H., XIV, 1914.

LIBIS.

L. ducalis.

L. ducalis, Smith, Bingham, p. 207, F.B.I., i., 1897.

L. nigripennis, Cam., Bingham, p. 206, do. do. Poona.

L. ducalis, Turner, p. 257, A.M.N.H., XIV, 1914.

DIPLOPTERA.

Notes on the nesting habits of some solitary wasps—Parker, p. 70, Proc. Ent. Soc., Wash., 1915.

* New to the region.

Habits of a mud dauber—*Eumenes latreille*, Sauss—Girault, p. 28, Zt. fur. Wies. Ins., 1914.

On the species of 'Alastor' and other Eumenidæ—Perkins, p. 563, P.Z.S., Pt. II, 1914.

Notes on Belonogaster—Saussure, p. 199, Ann. Soc. Ent. Fr., 1909.

'Belonogaster' and Tachinids—Lamborn, p. XXXIX, T.E.S. II, 1914.

Notes on Wasps and colours of wasps—Perkins, p. 677, T.E.S., 1912.

ANTHOPHILA.

APIDÆ.

SPHECODES.

S. turneri, Cockerell, p. 430, A.M.N.H., XVII, 1916, Assam.

HALICTUS.

H. vinctus.

Nomia cineta, Wlk., 1860, Ceylon.

Nomia cineta, Bingham, p. 458, F.B.I., i., 1897.

Halictus kalutara, Cock, (see under 'Halictus' above).

Halictus vinctus, Meade Waldo, p. 449, A.M.N.H., XVII, 1916.

NOMIA.

Nomia—Notes on the genus and sub-genera—Meade Waldo, p. 454, A.M.N.H., XVII, 1916.

N. exagens.

Halictus timidus, Bingham, p. 429, F.B.I., i., 1897.

Andrena exagens, Wlk., p. 305, A.M.N.H., 1860, Ceylon (see under 'Andrena' above).

Nomia exagens, Meade Waldo, p. 459, A.M.N.H., XVII, 1916.

N. aurifrons, Smith, Meade Waldo, p. 459, A.M.N.H., XVII, 1916.

N. fuscipennis, Smith, Meade Waldo, p. 459, do. do.

N. scutellata.

N. scutellata, Smith—Bingham, p. 458, F.B.I., i., 1897, ♀.

N. albofimbriata, Cam. (see above under 'Nomia', ♀.)

N. ustula, Cock (do. do. Ceylon. ♂.)

N. scutellata, Meade Waldo, p. 461, A.M.N.H., XVII, 1916.

N. antennata var *sykesiana*, West.—a well marked variety, Meade Waldo, p. 461, A.M.N.H., XVI, 1916.

N. carinata, Smith, Nelliottii Smith, Meade Waldo, p. 461, A.M.N.H., XVII, 1916.

MEGACHILE.

Sense of locality of a leaf cutting bee, Muir, p. 375, B. J., XXIV, 1916.

TETRALONIA.

Tetralonia—Note on the genus, Cameron, p. 76, Mem. Manch. Soc., XLII (11), 1898.

T. duvaucelli, Lepel, Sexes, Cameron, p. 49, D. Ent. Zs., 1909.

ANTHOPHORA.

A. rowlandi, Meade Waldo, p. 50, A.M.N.H., XIII, 1914, Assam.

A. pseudobomboides, Meade Waldo, p. 53, do. do. do.

XYLOCOPA.

X. amethystina, F. Friese, p. 88, D. Ent. Zs., 1913.

APIS.

A. binghami var *sladeni*, Cock, p. 13, A.M.N.H., XIV, 1914, Khasia.

MELITTA.

M. harrictæ.

Andrena harrictæ, Bingham, p. 446, F.B.I., i., 1897.

Melitta altissima, Cockerell (see under '*Melitta*' above).

Melitta harrictæ, Meade Waldo, p. 462, A.M.N.H., XVII, 1916.

M. anthophoroides, Meade Waldo, p. 463, A.M.N.H., XVII, 1916, Sikkim.

BOMBUS.

B. lapidarius, L. var. *gilgitensis*.

B. gilgitensis, Cock (see under '*Bombus*' above).—Meade Waldo, p. 467, A.M.N.H., XVII, 1916.

B. alienus, Smith,* Meade Waldo, p. 468, A.M.N.H., XVII, 1916, Assam.

B. longiceps, Smith,† Meade Waldo, p. 468, A.M.N.H., XVII, 1916, Kashmir.

EPEOLUS.

Synopses of Epeolinae—Robertson, p. 284, Canad. Ent., 1903.

TRINCHOSTOMA.

T. assamensis, Sladen, p. 214, Canad. Ent., 1915, Assam.

It is still possible that I might have omitted some new species or important references. As such, I shall be very grateful to those of your readers who might be able to point out these omissions or any errors in my Catalogue, as it will greatly help me in the future.

* Omitted by Bingham.

† New to the region.

BUTTERFLIES OF THARRAWADDY AND THE PEGU YOMA.

BY

E. V. ELLIS, I.F.S.

With a Map.

The accompanying list deals chiefly with butterflies caught in the Tharrawaddy District, which lies on the western slopes of the Pegu Yoma, but for the sake of completeness reference has been made to others caught in Prome, Rangoon, Henzada and Toungoo Districts.

The Pegu Yoma forests seem to house an interesting set of butterflies, as they form the meeting place for Malayan and Assam types, and yet they are isolated by paddy plains and big rivers on both sides. They begin at Rangoon and extend to Mt. Popa in Meiktila, more or less. The jungles of the Tharrawaddy District are chiefly at a low elevation, under 500 feet, but towards their Eastern boundary they rise to 2,600 feet in the main ridge. There are three main types of jungle, each inhabited by characteristic insects:—

i. Deciduous bamboo jungle, fairly dry in the hot weather.

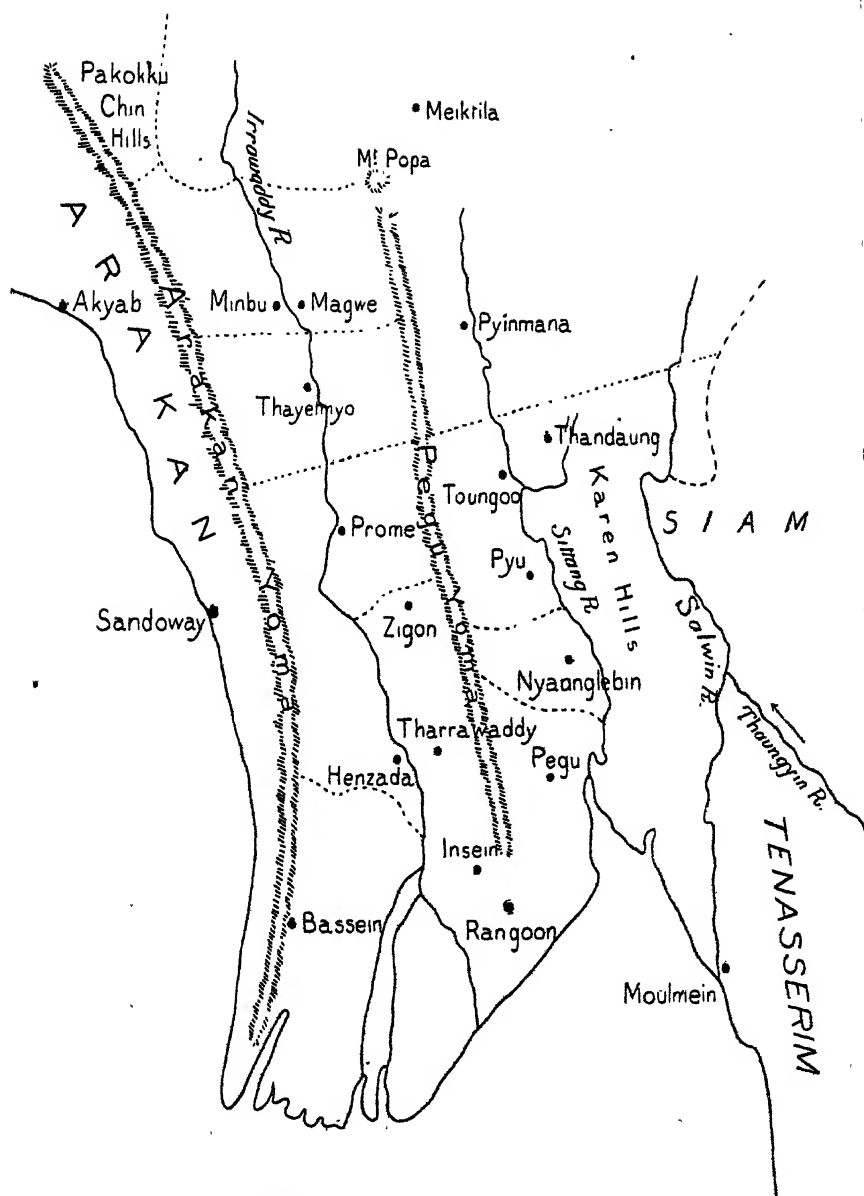
This covers 90 per cent. of the area.

ii. Evergreen jungle found in local patches near certain streams, very rich in species.

iii. "Indaing" jungle, low level gravel, etc., characterized by the presence of *Dipterocarpus tuberculatus*, the "In" tree. This is inhabited especially by *Arhopala toungwa*, *hewitsoni* and *centaurea* and *Elymnias tinctoria*.

Of the other districts mentioned, Prome adjoins Tharrawaddy on the north, and Toungoo adjoins it on the east, being on the opposite slope of the Yomas. Rangoon, situated at the tail of the Yoma, is surrounded by patches of evergreen forest in which rather more Malayan types appear. Henzada lies to the west across the Irrawaddy, and consists of broad and rather dry plains backing on to the hills of the Arakan Yoma which rises to 5,000 ft. The butterflies from the plain forests of Henzada are the same as those met with in Tharrawaddy plains forests, but the hill insects are rather different.

The present list cannot pretend to be complete for such a wide area as the Pegu Yoma, but it represents four years collecting in Tharrawaddy, and should be fairly complete for that District. To finish the Pegu Yoma butterflies more research is needed in the mountain forests on its eastern slopes in the Pegu and Toungoo Districts. It is hoped that the present list will assist anyone engaged in that work. Finally I must express my great obligation to



Scale approx. 1" = 60 miles
 ----- = District boundaries.

MAP OF THE THARRAWADDY AND THE
 PEGU YOMA, LOWER BURMA.

1
2

Major W. H. Evans, R.E., who has very kindly identified all doubtful specimens and helped me in every way possible.

NYMPHALIDÆ.

Danainæ.

1. *Danais aglea melanoides*, M. Very common everywhere. I have obtained *D. agleoides* around Rangoon and from Bassein. In the former place, at any rate, it was flying with *melanoides*, but it seems to reach its northern limit about Rangoon and I have met with none in Tharrawaddy, Toungoo or further north.

2. *D. limniace*, Cr. Very common everywhere.

3. *D. plexippus*, L. Very common.

4. *D. chrysippus*, L. Very common.

I have *D. melanippus indicus*, Fruh. From Rangoon but it comes no further north.

5. *Euplaea godarti*, Lucas. This is the common *Euplaea* of Lower Burma, and it is found in profusion throughout Tharrawaddy. The dimorph, *layardi*, Druce, seems to be rare, and I only have one from the Henzada District.

6. *E. alcathoe asatia*, Fruh. Not common. I got it once in the Thonze Reserve on 2nd March 1913. *E. harrisi hopei* should occur but I have not met with it.

7. *E. mulciber*, Cr. Very common.

8. *E. crassa*, But. Not uncommon and probably many could be got in the right place. Of four specimens that I have set, one, a rains form, might probably be called *masoni*, Moore, while the other three which are d. s. f. seem from the scanty descriptions in Seitz to be equally referable to *crassa apicalis*, *pembertonii* or *burmeisteri*.

9. *E. diocletiana*, Fabr. This is not common, but I obtained it in the Thonze Reserve in May 1912. Like *E. alcathoe* and *crassa* it prefers moister jungle than is usually met with in Tharrawaddy.

Satyrinae.

10. *Ypthina hübnéri*, Kir. Very common everywhere.

11. *Y. watsoni*, M. Fairly common in the forest and obtained a good series in January, February and onwards.

12. *Y. philomela indecora*, M. As mentioned by M. H. Evans in Journal, B. N. H. S., Vol. XXII, No. 2, page 282. I obtained a good series of this insect in February 1913 at Yetho and Sanbok villages. I also find I have it from the Henzada District.

13. *Y. baldus*, Fabr. Very common. Whether I have mixed up *sobrina* and *similis* among my *baldus* I cannot say, but it seems likely.

14. *Y. dohertyi*, M. One specimen from the Kyanktada hill on the Yoma, 2,640', on 16th November 1911.

15. *Y. savara*, G-Smith. Common from February onwards. I have met it in other parts of Burma where it was also common, from the Arakan Yoma in Minbu District to the North Shan States close to Yunnan.

16. *Erites rotundata*, de Nic. This is a local insect, but when found can be obtained in numbers. Particularly frequents bamboo jungles and flies

weakly in their dense shade, settling on their stems or leaves. All my specimens seems to be *rotundata* and not *angularis*; they are all d. s. f. The insect appears in February.

17. *Lethe europa*, Fabr. This is common in the forest and usually sits on the banks of dry streams, a habit all *Lethes* seem to have.

18. *L. confusa*, Aurivill. Also common.

19. *L. minerva*, Fabr. One male and two females from the Taungnyo Reserve. Rare specimens taken on 18th February 1911 and 18th April 1911.

I also have this from the North Shan States and from Toungoo.

20. *L. mekara*, M. Rather commoner than *chandica* or *vindhya*. Emerges in February also. I have record of seven Tharrawaddy specimens, ranging from 31st January 1911 to 3rd May 1912 and one on 14th November 1911. They come from the Taungnyo, Bawbin and Bilin Reserves, and one from the Taungnyomyo.

21. *L. chandica*, M. Not common. Emerges in March. Bawbin Reserve 14th November 1911, also Konbilin Reserve.

22. *L. vindhya*, Felder. Not common. Appears in February. Konbilin and Yetho streams on 16th February 1911 and 12th February 1912.

23. *L. muirheadi bhima*, Mar. Rare. I caught one (3rd May 1911) and saw two others in the Taungnyo Reserve—Pannyogale stream.

Very common in the North Shan States in April and May.

24. *Mycalesis anaxioides*, Mar. One from the source of the Mokka stream, where there is perennial water and evergreen forest, on 20th January 1912.

25. *M. perseus*, Fabr. Occurs all the year round, fairly plentifully.

26. *M. mineus*, L. This also occurs, but rather sparingly and I have only taken a few.

27. *M. perseoides*, M. This is the common *Mycalesis* of Lower Burma and is to be met with everywhere and at all seasons.

28. *M. intermedia*, M. This doubtless occurs, as I have it from Rangoon in November, but at present I have not been able to distinguish it from the preceding species.

29. *M. malsara*, M. This occurs fairly commonly in the forest. It appears towards the end of February.

30. *M. mnasicles perna*, Fruh. This appears in March and is only found in heavy bamboo jungle. The banks of dry water courses, especially quite small ones, are the usual places to find it. It seems local, but is not uncommon when the right locality is found. Konbilin in March.

31. *M. mytes*, de Nic. Another species that does not fly in the cold weather but only appears towards the end of February. Then it is not uncommon and several may be got in any day's collecting if attention is given to *mycalesis*. They are found in bamboo jungle, and settle on the ground on the dead bamboo leaves, where the yellow of their undersides is not conspicuous.

32. *M. neda*, Fabr. This is very common: forms with the white stripe obsolescent are found not infrequently, flying with striped specimens so that this variation does not seem to be seasonal. *M. risala*, M., does not seem to occur, and I have not differentiated *M. subdita*.

33. *Melanitis leda ismene*. Cr. Very common.

34. *M. phedima bela*, M. Not common. Only a few taken.

35. *Anadebis diademoides*, M. To be found in the moister parts of the jungle and especially flies along streams that contain running water. Obtained at the source of the Mokka at end of January and also in the Bawbin Reserve.

36. *Elymnias hypermnestra tinctoria*, M. Occurs, but not commonly. Often found in Indaing jungle, December and January.

37. *E. nesaea timandra*, Wallace. I took four on the top of the Yoma, Kyantada hill, 2,640 feet, on 16th November 1911. 3 ♂ and 1 ♀. I have seen it nowhere else in Tharrawaddy.

Morphinae.

38. *Clerome arcesilaus*, Fabr. Not common and only found in evergreen forest. Thonze Reserve in May.

39. *Thauria aliris intermedia*, Crowley. I have got three; all at the sources of streams near the Yoma. Inhabits evergreen forest.

40. *Discophora celinde continentalis*, Staud. Seems to be rare. I have one ♂ from the Bilin stream (3rd February 1912). From the Arakan Yoma in Henzada I have 1 ♂ and 2 ♀ taken on 2nd January 1912; 14th March 1912 and a rains ♀.

41. *D. tullia indica*, Staud. Common but hard to take. It sits on the stems of bamboos well protected by the rest of the clump. Only found in the moister bamboo jungle. Appears at the end of February.

42. *Enispe euthymius*, Doubl. Fairly common, and seems to occur in any kind of jungle. The form I have taken in the dry season is *tessellata* M. The prominence of the discal bar on the underside varies a good deal.

Nymphalida.

43. *Charaxes polyxena hierax*, Felder. Not very common. Occurs in January and February.

44. *C. fabius sulphureus*, Roth. Not common. I have taken it at the end of February.

45. *Eulepis athamas*, Drury. This is common and pugnacious. Usually it is found sitting on some point of vantage whence it chases everything.

46. *E. arja*, Felder. This is not common. One from the Bawbin stream on 17th November 1911. I only have three others, one from Toungoo and two from Maymyo.

47. *E. deephis concha*, Wd. Rare. I have taken only two and seen no more. Koubilin Reserve, 12th February 1912, and Mokka Reserve, 15th February 1913.

48. *E. eudamippus*, Doub. Rare. I found this once at the source of the Mwegyi stream, Taungnyo Reserve (18th April 1911) and caught two out of a fair number seen. When alarmed they flew to the tops of trees and one specimen I fetched down very luckily with my net stuck precariously into a 30 foot dead bamboo.

I have *eudamippus* also from the Minbu District in February (Dive stream) and the form *nigrobasalis*, Lathy, from the N. Shan States in May.

49. *Apatura ambica*, Koll. I obtained one, a female, in the Taungnyo Reserve, Wetto stream source on 16th February 1911. This is the only one I have seen in Tharrawaddy. She was settled on a small bamboo-like grass which grows beside streams.

50. *A. parisatis*, God. I have only seen one, a ♂. It was on the Kyauktada hill, Bawbin Reserve in November.

51. *Euripus halitherses*, Doub. Again I have only seen one, a male, and that I caught in the Wetto stream, Taungnyo Reserve on 16th February 1911, at 500 feet elevation.

52. *Dichorragia nesimachus*, Boisd. I saw one, but did not catch it, at the source of the Bawbin stream, 600 feet elevation, in a rather evergreen bit of jungle. Usually it seems to occur at higher elevations than this.

53. *Adolias dirtea*, Fabr. Very common in the forest all the year round. The form that occurs seems to be *jadeitina*, Fruh. The submarginal series of spots on the upper side of the hind wing varies in size to a considerable extent, and to a less extent in shape.

54. *Euthalia derma*, Koll. Not very common and seems confined to moist evergreen jungle, but I have seen it in "Indaing" jungle also. Thonze Reserve in May. Seywa in January. Kyini Reserve in February.

55. *E. lepidea*, But. The commonest *Euthalia*: found at all times of the year, rains forms are darker than d. s. f.

56. *E. appiades julii*, Bougain. Both sexes of this are common, and the form that flies in Tharrawaddy seems nearest to *julii*.

57. *E. jahnu*, M. This also is fairly common and I have taken both sexes. February-March.

58. *E. anosis*, M. One worn specimen taken in April in the Thonze Reserve. It insisted on sitting on the roof inside a bungalow, and after half an hour's chasing, during which it left the place once but returned, it allowed itself to be caught. In February I saw another, a fresh specimen, but had no net with me and it was not docile enough for the finger and thumb method.

59. *E. kesava rangoonensis*, Sw. I do not seem to have got this from Tharrawaddy, but it should occur. It never seems to be common anywhere.

60. *E. apicalis*, Voll. I have one male taken in my garden in Tharrawaddy in April.

61. *E. phemius*, Doub. One good specimen on 5th May 1912 in moist evergreen jungle in the Thonze Reserve.

62. *E. lubentina*, Cr. One female on the Taungnyo-myo in April, and I saw another in the Thonze Reserve in May.

63. *E. garuda*, M. Not so common as *lepidea*, *appiades* or *jahnu*. I got one on the Kyauktada hill, 2,640 feet, on 16th November 1911, and others at lower levels.

64. *E. jama*, Felder. I obtained what I take to be a female of this on the Kyauktada hill on 16th November 1911.

65. *E. erythra*, de Née. This flies with *appiades* and I did not distinguish the females at first. Both sexes were obtained in February and March, but either the female is commoner than the male, which is not usual with *Euthalia*, or I have been overlooking it as I only have the one worn male.

Of the above species of *Euthalia*, *appiades*, *jahnu* and *lepidea* are the common ones which occur in most kinds of jungle. The occurrence of the other species is dependant on the existence of evergreen forest, in patches of which single specimens have been found.

66. *Parthenos gambrisius*, Fabr. Not plentiful, as it prefers moisture forest than is usually found in Tharrawaddy.

67. *Liminitis procris*, Cr. Fairly common in the forest, and I have also seen it in the railway town of Letpadan, quite 8 miles from the nearest bit of good jungle.

68. *Lebadea martha*, Fabr. Usually to be found when one meets with a patch of evergreen jungle.

69. *Pantoporia nefte inara*, Doub. One from the Kyantada hill, 2,640 feet, on 16th November 1911. I have not seen any others in Tharrawaddy and think it prefers a higher elevation, over 3,000 feet.

P. selenophora and *P. cama* may also occur on the top of the Yoma, but I have not met with them.

70. *P. kanwa*, M. I obtained this on the Yoma crest in the Kadin Bilin Reserve (1st February 1913) at an elevation of about 1,500 feet. Again in the Mokka Reserve in January and February 1913.

71. *P. ranga*, M. Two from the Kyantada hill on 16th November 1911. Not seen again.

72. *P. perius*, L. Very common at all elevations.

73. *P. pravara*, M. Obtained in the Thonze Reserve in May 1912, and again in the Mokka Reserve in February 1913.

74. *Neptis hylas adara*, M. Very common and various in size. All the year round.

75. *N. soma*, M. Also very common and exceedingly variable, some specimens being quite minute in size. January-February and all the year.

76. *M. columella martabana*, M. Common locally: it also seems to vary much, some specimens having the white markings so reduced as to give the insect quite a different look. (9th March 1912).

77. *N. harita*, M. Two or three specimens from the Thonze Reserve. (4th May 1912).

78. *N. viraja*, M. I got this from both the Kyantada and Kanbalu hills in November 1911. Both are hills on the Yoma about 2,600 feet high.

79. *N. heliodore*, Fabr. This is not very common, but occurs at low elevations along with *paraka*, with which it is easily confused.

80. *N. hordonia*, Stoll. Very common at all elevations and at all times of the year.

81. *N. paraka*, But. Also common, nearly equally with the last named from which it is not to be distinguished until caught. It always settles with its wings wide open, so that one has no chance of a glimpse of its under side.

82. *Cyrestis risa*, Doub.

83. *C. rahria rahrioides*, M. } These two forms fly together, and are to be found chiefly in streams in moist jungle. I have record of their capture in January, February, October and December.

84. *Junonia iphita*, Cr. Common all the year round both in jungle and gardens.

85. *J. lemonias*, L. Still more common.

86. *J. hierta*, Fabr. Also very common everywhere.

87. *J. orithya*, L. Not quite so common. Most usually found on short herbage.

88. *J. atlites*, Joh. Fairly common. Chiefly found in gardens.

89. *J. almana*, L. Very common.

90. *Symbrenthia lucina*, Cr. Common in the jungle. I have found no *Vanessa* in Tharrawaddy, but *V. cardui*, should occur as I have it from the Promé hill in July 1909.

91. *Rhinopalpa polynice birmana*, Fruh. Though I have not actually caught this, I saw it in the Mokka stream in January.

92. *Foma sabina vasuki*, Dohert. Common in the jungle. The rains brood is markedly darker than the hot weather brood that it succeeds. The d. s. f. begins to appear in February, and the insects flying at the end of April and beginning of May are very battered and pale. With the first good showers in May the w. s. f. appears. May 19 is a date I have noted for this. The insects are fond of settling on cattle-stamped mud round village wells, inside the wells on the damp bricks, or along roads through the jungle. Kangyi Reserve in May.

93. *Hypolimnas bolina*, L. Very common. I have not caught *H. misippus* L. in Tharrawaddy, but it must occur.

94. *Penthema yoma*, Mihi. Two specimens of this from the Myaung stream (Gamon Reserve) and from the Thabyu stream (Thonze Reserve), both in May, 1909 and 1912. It inhabits moist jungle, and seems to be the kind of *Penthema* peculiar to the Pegu Yoma forests. I have *P. lisarda* from the Henzada District and *P. darlisa* from the foot of the Karen Hills in Toungoo District. The type specimen of *P. yoma* is in the B. M. and was recently described by me in the journal of the B. N. H. S., Vol. XXII, page 585. February 2nd, 1915.

95. *Kallima inachus limborgi*, M. Not common, as there is not much of the evergreen jungle it prefers. It is sometimes found in "Indaing" jungle.

96. *Isoria Sika*, Koll. Not very common. Occurs in the jungle.

97. *Atella phalantha*, Drury. Very common everywhere. I have not obtained *A. alcippe alceipoides* and find it much rarer and limited to Tenasserim and East Toungoo as far as my experience goes as yet.

98. *Cupha erymanthis lotis*, Sulz. Very common everywhere.

99. *Cirrochroa mithila*, M. Not very common, but I have records of it from the Bawbin Reserve on 13th November 1911 and again in April in the Thonze Reserve.

100. *Ergolis ariadne*, Johans. Never very common but to be found in most jungle.

101. *Ergolis merione*, Cr. About equally common.

102. *Laranga korfeldti glaucescens*, de Nec. I obtained this on the top of the Yoma at 2,600 feet, three on the Kyanktada hill, 16th November 1911, and two on the Kaubalu hill, 20th November 1911—four males and one female. I have not seen it elsewhere in Tharrawaddy.

103. *Pseudergolis wedak*, Koll. Not very common.

104. *Cethonia cyane*, Drury. Not common, and seems to inhabit open Savannah jungle by preference, or gardens. Bingham records *C. hypstina*, Fd., from the Pegu Yoma. I have not found it.

105. *Libythea myrrha*, Godart. I have this from Henzada and Toungoo but seem to have failed to take it in Tharrawaddy.

NEMEOBIDÆ.

106. *Zemeros flegyas*, Cr. Fairly common in moist jungle.

107. *Taxila haquimus fasciata*, M. I have obtained three specimens only in Tharrawaddy. The jungle does not appear to be moist enough for them. One was from the Bawbin Reserve on 25th January 1911 and the others from the Mokka Reserve on 19th January 1912.

108. *Abisara echerius angulata*, M. Very common and variable. Presumably my specimens are this race. I have taken no *Dodona* in the Pegu Yoma as yet.

PAPILIONIDÆ.

109. *Papilio helena cerberus*, Felder. } Both occur not uncommonly, and
110. *P. œacus*, Felder. } are found either in or out of jungle.
They frequent the white flowers of a flowering shrub.

111. *P. zaleucus*, Hew. Four, taken in streams in the forest.

112. *P. aristolochiæ*, Fabr. The race *goniopeltis*, Roth., is common everywhere, and is the commonest *Papilio* of the district.

113. *P. clytia*, L. *Clytia* and *dissimilis* forms are equally common and are especially found in gardens.

114. *P. mahadeva*, M. One specimen was obtained, caught in a hat! Thonze Reserve.

115. *P. demoleus*, L. The form *malayanus*, Wall., is nearly as common as *aristolochiæ*. It inhabits gardens by preference, but is to be met with everywhere.

116. *P. chaon*, Westw. Flies with *helenus*. One specimen, dated 25th February 1912.

117. *P. helenus*, L. I first found this in November on the top of the Yoma at 2,600 feet, but later on I also found it at lower elevations. It usually seems to follow a well defined "path" of its own, and I have not often found it loitering. Exclusively a forest insect, in this district at any rate. Kaubala Hill, 20th November 1911.

118. *P. polytes romulus*, Cr. Common, but I have only found the *polytes* form of ♀ as yet.

119. *P. memnon agenor*, L. Not very common, but sometimes met with in gardens on flowers of *Hibiscus*, etc. The dark males seem always to lack the red mark at the base of the cell on the underside of the fore wing. I have caught two forms of ♀; *agenor*, L. and *alcenor*, Cr.

120. *P. palinurus*, Fabr. I have caught two—one in my hand when feeding on wet sand, and I have seen two others. Rare, and appears to be confined to jungle.

121. *P. nomius swinhœi*, M. Common in the jungle, appearing towards the end of Feb. Often found settled in clouds on wet sand.

122. *P. aristæus hermoorates*, Felder. I have only caught two, and it was with the same sweep of the net that also caught two *Swinhœi*. They were settled thickly by a pool on the sand, evidently intermingled. I could not find another though I netted innumerable *Swinhœi* afterwards in a vain search.

123. *P. sarpedon*, L. Not very common.

124. *P. agamemnon*, L. Not common.

125. *Leptocircus meges virescens*, But. I saw this at the source of the Mokka stream in evergreen jungle, but was unable to catch it. Feb.

PIERIDÆ.

126. *Leptosia riphia*, Fabr. Common at all times of the year in the forest.

127. *Delias descombesi leucacantha*, Fruh. From the top of the Pegu Yoma, at 2,600 feet in November 1911.

128. *Delias aglaia*, L. From the top of the Yoma also, in November.

Delias seem to prefer higher altitudes than Tharrawaddy can provide, at I have *agostina*, *hierta*, and *pyramus* from the Arakan Yoma in the Henzada District. From the Toungoo district I also have *hierte* from low elevations, taken at flowers in my garden there.

129. *Huphina neriesa dapha*, M. Fairly common.

130. *Huphina nadina*, Lucas. I have no specimen of this from Tharrawaddy, but it must have been passed over. I have a ♀ from Prome and several specimens from Henzada. *Lea*. does not come so far north in the Irrawaddy valley although it extends up the Sittang valley to Toungoo.

131. *Appias lyncida hippoides*, M. Fairly common, but I did not take many. One female from Kyankwa on 5th May 1911, and a few males at different dates.

132. *Appias libythea zelnira*, Cr. Fairly common. Rains forms occur from the end of May until December. I have a fresh specimen of the w. s. f. from the Bawbin Reserve, dated 19th November 1911.

133. *A. albina confusa*, Fruh. Not common. I only have one female from the Pegu Yoma, 2,000 feet, dated 21st March 1912.

134. *A. melania adamsoni*, M. One specimen from Zigon in 1910. This is very similar to some *paulina* that I have from Ceylon.

135. *A. indra*, M. Only from the top of the Yoma. Two from 2,600 feet on 16th November 1911 and one from 2,000 feet on 21st March 1912.

136. *A. lalage*, Doub. Also only from the top of the Yoma. Two on 16th November 1911 from 2,600 feet elevation. Presumably they are the form *argyridina*. But, they are certainly not *lagela*, M., which might have been expected.

137. *Ixias pyrene latifasciata*, But. I have never seen an *Ixias* in the Tharrawaddy District. It occurs in other districts all round, and I have it from Prome (6th July 1911), Henzada and Toungoo (December 1905). I have also seen it in Rangoon.

138. *Catopsilia pyranthe*, L. Very common at all times of the year.

139. *C. croceale*, Cr. I have at present one male of the form *flavescens*. Fruh. (21st April 1911) and no females.

140. *C. pomona*, Fabr. This occurs more commonly and the female form *castilla*, Cr. also occurs. Until lately I had not separated *croceale* from *pomona* and gave the combined species but little attention in Tharrawaddy. Nearly all my *catopsilia* of are earlier captures. *Catopsilia* is common in Tharrawaddy but I am not in a position to say which particular form they are.

141. *Terias lola*, Boisd. Occurs. Bawbin Reserve, 31st November 1909.

142. *T. archia*, L. Very common all the year round.

143. *T. silhetana*, Wallace. This also occurs and I have specimens from the Mokka Reserve, 19th January 1912, and from the Taungnyo Reserve, 15th February 1912.

144. *T. andersoni*, M. I have specimens which I believe may be referred to this species, but I am not very sure about them.

145. *T. harina burmana*, M. This occurs, but not very commonly. I have specimens as follows:—

Kanbalu hill, 2,600 feet, 20th November 1911; Oamon Reserve, 3rd March 1911; Bawbin, 2nd May 1911; Taungnyo-myo, 9th June 1911; Pegu Yoma, 2nd May 1911.

The w. s. f. has more black on the tip of the wing than the d. s. f.

146. *Hebomoia glaucippe*, L. Common, especially at flowers in gardens. May also be seen in clearings and along open streams in the forest.

147. *Pareronia valeria hippia*, Fabr. Fairly common. Flies along its own paths through the jungle, preferring dry open stream beds. Rather hard to catch. Females are much rarer than males, but both forms occur that with yellow most commonly.

LYCENIDÆ.

Gerydinae.

148. *Gerydus biggsii*, Dist. One specimen of what must be this species was taken in the Yetho stream in March, but it does not agree very well with de Nicéville's figure of *G. gopara* which = *biggsii*.

I have not met with any of the more usual forms of *Gerydus* in Tharrawaddy.

149. *Allotinus drumila*, M. This does not seem to have been recorded from Burma yet. I got one specimen from the Sababontaung, 5,000 feet, on the Arakan Yoma, Henzada, on 6th April 1911.

150. *A. subviolaceus*, Felder. No *allotinus* is common in Tharrawaddy, but what I did catch were about equally divided between this species and *horsfieldi*, about six of each. Kyini Reserve.

151. *A. horsfieldi*, M. A few.

152. *A. nivalis*, Druce. I got two of these in a wet and shady streamlet in the Thonze Reserve in May 1912. They might easily be passed over as small moths on the wing.

153. *Logania marmorata*, M. One specimen which seems nearest to the form *watsoniana*, de N., was taken on 10th January 1913 at Panhle té on the Mokka stream. On the wing it exactly resembles *Lampides celeno*, which is very common, and what impelled me to catch it I do not know.

Lyceninae.

154. *Pithecopys hylax*, Fabr. I have no specimen from Tharrawaddy but believe it occurs. I have it from Henzada.

155. *Neopithecopys zalmora*, But. This is fairly common, but local. When the right locality has been found a fair number may be obtained, 19th January 1912; 14th April 1912; 10th May 1912.

156. *Taraka hamada*, Druce. I have only obtained one specimen in Tharrawaddy, in the Mokka Reserve in January 1913. Elsewhere, I found it very common in the North Shan States.

157. *Cyaniris marginata*, de Nec. Probably occurs but I have no Tharrawaddy specimen.

158. *C. puspa*, Hors. I have specimens as follows:—Bawbin Reserve, 3rd January 1911; Pegu Yoma, 21st January 1912; Kanbalu hill, 2nd February 1911 and 20th November 1911 (2,600 feet); Kyanktada hill, 16th November 1911 (2,640 feet). It seems commoner at high elevations, but I have low level specimens from Prome hill, 200 feet, dated 5th July 1911.

159. *C. jyntheana*, de Nec. I have two specimens of this from the Kanbalu hill, 2,600', dated 2nd February 1911. No others were met with.

160. *C. albidisca*, M. A cyaniris near to this was found in the Mokka stream on 20th January 1912.

161. *C. melæna*, Dohert. Two from the Kyanktada hill, 2,600 feet, on 16th November 1911.

162. *Chilades laius*, Cram. Not very common, but is sometimes met with in gardens.

163. *C. trochilus*, Frey. Very common wherever there is short grass and weeds in dry paddy fields, or on dry land liable to inundation.

164. *Zizera lysimon*, Hüb. Fairly often found, in localities similar to the last.

165. *Z. gaika*, Fabr. } Both are common, in open grassy places, and on
166. *Z. otis*, Fabr. } the bunds of paddy fields in the dry weather. *Z.*
maha, Koll., does not seem to occur in this district, although Bingham records it from Pegu.

167. *Eerces argiades dipora*, M. Not very common: found both inside and outside the forests.

168. *Catechrysops strabo*, Fabr. Very common everywhere *C. lithargyria* I have not been able to find.

169. *C. pandava*, Hors. Very common indeed. The form with confluent markings on the underside of the hindwing, which is figured by deNicéville (Fig. 188, Plate XXVII, Vol. III) as the d.s.f. of this insect is not exclusively so in Burma. The usual d.s.f. is very similar to the w.s.f., but is a little darker below. The form with confluent markings occurs also in some places, but much more rarely. I have specimens of it from Tharrawaddy, Henzada, and from an elevation of 3,000 feet in the Pakkoku Chin Hills (South Chin Hills).

170. *C. caryus*, Fabr. Only four examples taken. It is rather easy to confuse it with *Eerces argiades* at first glance.

171. *Tarucus leophrastus*, Fabr. I have two specimens from Henzada in May and from Prome in July 1909. It doubtless also occurs in Tharrawaddy but is rare.

172. *T. platus*, Fabr. Very common everywhere.

173. *Cassida rostrata*, Fabr. Common throughout the district.

174. *C. munda*, de Nec. I have obtained 3 specimens, Konbilin stream on 16th February 1912, Tonkyant stream on 6th February 1912 and Thonze Reserve on 4th May 1912.

The only previous record of this insect in Burma appears to be contained in Bates's list of Histeridae from the North Chin Hills published in Vol. 1, Part 1 of this Journal.

175. *C. rozus*, Godsat. A few specimens from some evergreen jungle on the Myaung stream in July 1911 and three from the Mokka stream in January 1912.

176. *C. decidia*, Hew. I got this at low elevations in Henzada so it should occur in Tharrawaddy, but I never found it.

177. *Niphanda cymbia marcia*, Few. This, if it may be so expressed, is one of the rarities that turn up fairly often. In all I have got six in Tharrawaddy; one from evergreen forest at the source of the Mokka stream on 21st January 1912, one from the Takawpi stream on 3rd February 1913, and four from the Taungnyo stream in 1909.

Elsewhere I found it commoner in the Pakokku Chin Hills at about 1,000 feet, and I have it from Maymyo.

178. *Lycænesthes emolus*, God. Fairly common and often found on wet sand by jungle streams.

179. *L. lycænina*, Felder. Not nearly so common as the last.

180. *Nacaduba viola*, M. One specimen from the Kyanktada hill, 2,640 feet, on 16th November 1911.

181. *N. kerriana*, Dist. Seven specimens from the same hill and on the same date. This species seems to be a Malayan one, and to be somewhat out of place in Tharrawaddy. I have it also from the foot of the Karen Hills in Toungoo.

182. *N. macrophthalma*, Felder. Three specimens of this from the same hill on the same date. On page 144 of Vol. III of his Butterflies of India, de Nicéville mentions an aberrational form of the male, from the Nilgiri Hills. I have seen this at the B. M. and I have specimens exactly matching it from Tharrawaddy (one from the Kyini Reserve). The blue colour on the upperside of all these aberrational insects is not the same as in typical *macrophthalma*, but is paler and nearer to the colour of *N. pavana*, Hors., of which species I should prefer to consider them aberrations.

I have what I take to be typical *macrophthalma* from two other localities in Burma. (Maymyo and Psthichaung in the Toungoo district.)

183. *N. pavana*, Hors. I have what I take to be this insect from the Kanbalu hill, 2,600 feet, on 2nd February 1911 and from Myanle on 29th March 1911.

184. *N. dana*, de Nec. The male of this is quite common, being usually found on wet sand, but the female I have not yet found.

185. *N. nora*, Felder. Also common, and frequently found in company with *dana* on wet sand.

186. *N. noreia*, Felder. Not very common.

187. *N. celestis*, de Nec. I have obtained seven, all males on various dates in January, February and September.

188. *N. atrata*, Hors. I do not seem to have got this, but I should have it.

189. *Lampides bochus*, Cr. Common, usually in streams in the forest.

190. *L. pura*, M. } Both occur, *celeno* most plentifully.

191. *L. celeno*, Cr. }

192. *L. elpis*, God. Fairly common, but the rarest of these four *Lampides* in Tharrawaddy.

Poritinae.

193. *Poritia hewitsoni*, M. In the Tharrawaddy District I have taken three insects that I take to be this, (10th February and 21st March 1912), but they are not constant among themselves and they all three differ from my other specimens in the possession of a large, isolated, black mark in the blue area in interspace 1 of the fore wing. All three have very little in the way of blue apical spots, and one has a broad black submarginal band on the hind wing, upperside, reaching from the anal angle to vein 4. These, however, would appear to be typical *hewitsoni* as they agree with Moore's description as given by de Nicéville.

I am considerably puzzled over *P. hewitsoni* and *erycinoides*. It seems easy to divide the males among these two species, *hewitsoni* being recognized by its greener colour, its black cell and the small sub-apical blue marks on the forewing. The distribution seems curious; I have the following:—

3 males from Tharrawaddy, elevation 800-2,000 feet.

2 males and 2 females from the North Shan States at low elevations.

1 male from Manipur.

The males from the Shan States and Manipur lack the solid black mark in interspace 1.

Of *erycinoides* I have:—

A quantity from Maymyo (3,000 feet) both sexes.

A long series from Thandaung (Karen Hills, 4,200 feet) all males.

Of the Maymyo females, (one pair was taken in Coitu) there are two kinds, those with and those without orange streaks on the upperside of both wings.

Thus nowhere have I found the two flying together, and if anything *hewitsoni* would seem to be the low level (or Assam) form and *erycinoides* the high level (or Malayan) form.

194. *P. phalia*, Hew. Two specimens from the Kyantada hill, 2,640 feet, on 16th November 1911.

195. *P. phalena*, Hew. One specimen from the same hill on the same day which agrees exactly with the description of *Harterti*, Doh.

196. *Curetis bulis*, Db. and Hew., Common. The form occurring is *malayica*, Fd., and has a white female.

Theclinae.

197. *Ilerda epicles*, God. One good female specimen from the Takawpi stream on 3rd February 1913. In Tharrawaddy this insect must reach its southern limit.

198. *Aphacis syama*, Hors. This is local in Tharrawaddy, but I found one spot where it was plentiful. The insects alighted on tall blades of grass, as *ictis* also does, and were of the form called *peguana*, M.

199. *A. ictis*, Hors. One specimen of this, 3rd February 1913. *A. ictis*, Hew., does not seem to occur, but I have a specimen from Henzada taken in March at an elevation of 3,800 feet. This appears to be typical, but a long series obtained in the North Shan States in March and April is not as the orange patch on the fore wing is much smaller and the area glossed with blue is larger.

Arhopalinae.

200. *Mastetia atthesani*, Hew. I found these common, when I had no one with me, by the Mimbu stream in July, flying around lopped trees and

shrubs in the plains beside the stream. Later I got some, all battered. Again I saw it, apparently fresh, near Sanbok village on 15th February 1912.

I have *M. ameria* from Henzada.

201. *Iraota timoleon*, Stoll. I have obtained one male from the Kyanktada hill, 2,600 feet, on 16th November 1911, where it was flying in company with more numerous *I. rochana*. I also got a female which came into the rest house and was there taken on the wing at Nyanle in the Taungnyo Reserve on 30th April 1911.

202. *I. rochana*, Hors. Four males from the Kyanktada hill as above and two more from the Kaubalu hill, 2,600 feet, on 20th November 1911, I have a female from the Gokteik viaduct caught in July 1912.

These captures extend the range of what seemed like a Malayan insect, and Col. Tytler further records it from Manipur.

203. *Amblypodia anita*, Hew. Rare. I have only got one male from an evergreen stream in the Thonze Reserve, 3rd May 1912.

204. *Surrendra quercetorum*, M. Not common. From the Bawbin Reserve, 1st February 1911 and at Prome on the hill in July.

205. *Arhopala centaurus*, Fab. Fairly common in the evergreen or "Indaing" jungle, December 1912. Kadin Bilin, February 1913, Sanbok, 15th February 1913.

206. *A. amantes amatrix*, de N. Very common in the beds of streams where it often settles on a willow-like shrub that grows there (*Hoya*).

207. *A. bazalus*, Hew. One specimen in the plains in country that is inundated during half the year, Kyankwa, 25th May 1912. An unexpected locality for an *Arhopala*.

208. *A. atosia arici*, Std. I obtained six examples of this in some evergreen jungle on the Thabelu stream, Thonze Reserve, in May.

209. *A. eumolphus farquhari*, Dist. A single specimen from the same stream in May.

210. *A. hecitusi*, B.B. This is very common in the "Indaing" jungle, settling on the broad leaves of the trees.

211. *A. toungva*, Gr. S. Common in company with the last named in "Indaing" jungle. The female is a much paler blue than the male. In Tharrawaddy I chiefly got the blue female but in Henzada I got mostly the purple male, from similar jungle. There are two distinct kinds of *A. toungva* and they probably merit names as they certainly represent constant forms, and may be two species. The males from wet jungle are darker, both in the blue colour of the upper side and in the ground colour below. The underside is also washed with pink. The females differ below in the same way and on the upperside much more resemble the colour of the male but females can always be distinguished by the extent of the blue colour. This darker form inhabits wet and evergreen jungle, while the other form inhabits dry "Indaing" forest and is paler both above and below with scarcely any pink wash below.

I have the dark variety from Rangoon and the Lower Thaungyin, the pale variety from Tharrawaddy, Henzada and Toungoo.

From Rangoon I have one female of the dark kind which possesses a dull green fore wing, the corresponding wing being blue as usual, with just a dusting of green scales in interspace 1a.

212. *A. aberrans*, de N. I have this from the Taungnyo Reserve. Also from Henzada.

Deudoriginae.

213. *Deudoric epijarbas*, M. One male from the Kyanktada hill, 2,600 feet, on 16th November 1911.

214. *Virachola isocrates*, Fabr. One male from the Kyanktada hill, 2,600 feet on 16th November 1911, and another from the Yoma top in the Thonze Reserve on 1st May 1912. A female from the Bawbin Reserve on 5th April 1911.

215. *V. perse*, Hew. One male each from the Kyanktada and Kanbalu hills, 16th and 20th November 1911, elevation 2,600 feet.

216. *Rapala schistacea*, M. Not very common. Obtained on 14th April 1912. Seems to fly at all times of the year.

217. *R. petosiris*, Hew. I have records from the Bawbin Reserve on 3rd April 1911, Taungnyo Reserve on 3rd May 1911 and from other places at various times from March to November.

218. *R. suffusa*, M. This is less common and I have it from the Mokka Reserve on 8th January 1913.

219. *R. jarbas*, Fab. Quite common in stream beds, March to May.

220. *Camena isetoides*, Elw. Four specimens that I take to be this form from the Kyanktada hill, 2,640 feet, on 16th November 1911.

221. *Tajuria jangala ravata*, M. Common from March onwards.

222. *T. maculata*, Hew. Two males from the Kyanktada hill, 2,600 feet, on 16th November 1911 and one female, which is smaller, from the Taungnyo Reserve on 12th February 1911 at an elevation of only 200 feet.

223. *Hypolycaena erylus*, God. Both sexes are fairly common, and come to wet sand, 14th November 1911, 25th January 1911, 9th May 1911.

224. *Chliaria othona*, Hew. Not common, but now and again to be met with in moist streams, 7th February 1912, 10th April 1912 and 3rd May 1912, one female only.

225. *C. merguis*, Doht. From the Thonze Reserve on 4th May 1912 and the Mokka Reserve on 6th January 1913. On the latter occasion it was flying round some blue flowers beside the stream and I mistook it for *E. etolus* or I could have got more than 4.

226. *Biduana melisa*, Hew. Twice in May 1912 in evergreen forest in the Thonze Reserve.

227. *Charitra freja*, Fabr. Not very common in Tharrawaddy, but I have notes of it from the Mwegyi stream, Taungnyo Reserve, on 18th April 1911 and from the Thonze Reserve on 6th May 1912.

228. *Zelus etolus*, Fab. Scarce in Tharrawaddy.

229. *Lisura atymnus*, Cr. Common in long grass, 3rd March 1911, April and May.

230. *Chorina mandarinus*, Hew. Only from the Kyanktada hill, 2,640 feet, on 16th November 1911; two.

231. *Catantopius elegans*, Druce. Four males from the same hill on the same day.

232. *Horaga novimela*, M. Three, again from the same hill on the same day. I only spent one day on this hill top, but in practically the same spot I made a bag that I shall never forget and probably never equal. Very rare insects did I find there. I never got a chance to repeat.

HESPERIDÆ.

Heperiinae.

238. *Celenorrhinus leucocera*, Koll. 1st February 1913, two.
239. *C. munda*, M. Occurs.
235. *C. chamunda*, M. Took the male.
236. *C. affinis*, Elw. and Edw. The male.
237. *C. aurivittata*, M. Bilin Reserve, 12th February 1913 and Taungnyo Reserve, 14th February 1911.
238. *Coladenia indrani uposatha*, Fruh. A few.
239. *Ctenoptilum vasava*, M. Sanbok village, 16th February 1913.
240. *C. multiguttata*, de Nec. Bilin Reserve, 4th February 1913. Six.
241. *Odontoptilum angulata*, Fd. Thewa Reserve, 2nd March 1913.
242. *Caprona syrichtus*, Feed. Common in all forest.
243. *C. ransonuettii alida*, de N. A single male. This was common in the North Shan States.
244. *Tagiades atticus*, Fabr. (formerly *ravi khasiana*). This was common and I have specimens as follows:—Mokka, 14th January 1913. Tharrawaddy, 14th June 1912. Tanbington, 25th December 1912. Taungnyo Reserve, 12th February 1911. Bilin Reserve, 28th January 1911, Kyini Reserve, 21st February 1913.
245. *T. obscurus meitana*, M. (formerly *alica*). I have this from the Taungnyo Reserve, February 1911.
246. *T. litigiosa*, Mosch. Thonze Reserve, 5th May 1911.
247. *T. pinwilli*, But. Occurs.
248. *Satarupa bhagava*, M. Kyini Reserve, 22nd February 1913.
249. *Sarangesa dasahara*, M. Tanbington, 25th December 1912. Mokka Reserve, 12th January 1913. Bilin Reserve, 6th February 1913. Thonze Reserve, 3rd May 1913. Common.
250. *Sancus pulligo subfasciatus*, M. Seywa, 2nd January 1913, and Bilin Reserve in January.
251. *Astictopterus henrici*, Holland. Bynle.
252. *Koruthaialos xanites*, But. Bilin Reserve, 30th January 1913.
253. *Suaeda swerga*, de Nec. I have this.
254. *Suastus gremius*, Fabr. and this.
255. *Taractrocera merius*, Fabr. Not taken but it must occur.
256. *Janbric salsaara*, M. Seywa, 3rd January 1913.
257. *Aeromachus indistincta*, M. Sanbok, 16th February 1913, Mokka Reserve, 14th January 1913. Common, in company with *T. merius* usually, on the heads of a yellow flower of the order, compositæ.
258. *Sebastonyma dolopia*, Hew. Occurs.
259. *Hyaratis adrastus*, Cr. Tanbington, 25th December 1912.
260. *Arnetta atkinsoni*, M. Mokka Reserve, 8th January 1913. Bilin Reserve, 31st January 1913. Kyini Reserve, 22nd February 1913.
261. *Scobura cephalæ*, Hew. Bilin Reserve, 3rd February 1913.

262. *Gangara thyrsis*, Fabr. I bred a lot from a caterpillar covered with a white fluffy excretion that I found rolled up inside leaves of *Calamus erectus* in my garden in Tharrawaddy. There appeared to be two distinct broods in the rains.

I also saw the insect on the wing in Rangoon, outside the Pegu club in July.

263. *Matapa aria*, M. Common in the jungle all the season. Noticeable for its red eyes. Taungnyo Reserve, 14th February 1911. Pegu Yoma, 1st February 1913. Bawbin Reserve, 1st February 1911. Mokka Reserve, 12th January 1913.

264. *Kerana diocles*, M. Mokka Reserve, 14th January 1913.

265. *Notacrypta feisthamelii*, Bdl.

266. *N. restricta*, M. Mokka, 10th January 1913.

267. *Mdaspes folus*, Cr. Pegu Yoma, 6th April 1912. Fairly common.

268. *Cupitha purrea*, M.

269. *Telicota bambusa*, M. Very common. Bilin Reserve, 31st January 1913—4th February 1913.

270. *T. dara*, Koll. Also common. 1st February 1913.

271. *Halpe zema*, Hew. Mokka, 10th January 1913. Bilin, 6th February 1913.

272. *H. moorei*, Wat. Occurs.

273. *H. burmana*, Swink. Occurs.

274. *H. sikkima*, M. Occurs.

275. *Iton semamora*, M. Also occurs.

276. *Parnara oecia*, Hew. Seywa, 4th January 1912. Bilin Reserve, 4th February 1913.

277. *P. mathias*, Fabr. Sanbok, 16th February 1913. Mokka Reserve, 10th January 1913.

278. *P. toona*, M. (=contigua).

279. *P. bada*, M.

280. *P. bevani*, M.

281. *Imene mahintha*, M.

282. *Badamia exclamatoria*, Fabr. Everywhere.

The foregoing list has been finished rather hurriedly during 10 days' leave from the front, but it does not seem much use to postpone it further. It represents captures during five seasons, as I was posted at Tharrawaddy from April 1909 until March 1913. In this time I visited nearly every part of the district and had one collector helping me, but I did not get as many chances of visiting hills on the Yoma top as I should have liked. The few visits I was able to pay to such hills were very prolific in their results.

I think one conclusion to be drawn from this list is that many types considered typically Malayan, may extend to the Pegu Yoma in suitable localities: they also extend farther north along the foot of the Karen hills, and I have found *Cyrestis perimede* at the Gokteik viaduct in the Southern Shan States. The map will explain the Districts.

THE GAME FISHES OF THE PERSIAN GULF.

BY

MAJOR W. H. LANE.

PART II.

(Continued from page 748 of Vol. XXIV.)

In the previous paper dealing with the game fishes of the Persian Gulf, it will be remembered that the merits and demerits of the surface feeders were fully discussed. The next group of fishes to which our attention will be directed is the

FLY TAKERS.

Every fly angler, whose heart is in the Highlands but whose duty, business or pleasure turns his footsteps to the Persian Gulf, will be delighted to learn that at Jask he can also indulge in his favourite pastime.

There is one species of fish that provides excellent sport with a loch-sized trout fly. His local name is a regular jaw-cracker, and was discarded from the very out-set. Now, among the upper angling ten at any rate, he bears the homely name of

THE TIDDLER.

This *sobriquet* has been handed down by each successive generation of military exiles, and doubtless the practice will be continued *ad infinitum*. But let us array him for once in all his cognominal glory. Here he is:—

Family = PERCIDÆ.

Species = *Lutjanus fulviflamma*.

The characteristics of this lively little perchlet could not be adequately portrayed by means of a photograph: a description is therefore appended to assist identification.

Teeth.—Sharp conical teeth on both jaws, villiform teeth on vomer palate, and tip of tongue.

Eye.—Large and situated laterally, iris a brilliant yellow.

Fins dorsal.—There is one dorsal fin, but it is divided into two portions. The anterior portion is composed of 9 hard and sharp spines connected by transparent membrane. The posterior portion is rayed.

Pectoral.—Termination of pectoral reaches to about 1st third of black blotch on lateral line.

Caudal slightly forked.

Anal.—Three spines situated anteriorly, of which the third spine is distinctly longer than the second.

Lateral line.—Curves upwards from the gills and descends gradually towards the tail.

Scales.—Smallish in size and transparent.

Colour.—Back of a greenish hue and belly white; caudal coloured yellowish green; pectoral, pelvic and anal all golden; five golden bars running longitudinally from gill plates to tail; black blotch on the lateral line about $\frac{1}{2}$ way between the root of the tail and edge of the gill plates.

The Tiddler is essentially a shore fish, and there are particular haunts round the rocky parts of Cape Jask, and in the adjoining creek, where *fulviflamma* is found in shoals. The difference in level between high and low spring tides is 9 feet, and it can therefore be readily imagined that it is essential to select a suitable state of the tide. At low tide the favourite holts are high and dry, and the Tiddler has sought other retreats; on

the other hand at high tide the clefts in the rocks, behind the shelter of which the Tiddler lies secure from the buffeting of the waves, may be covered with six feet of water. In this case a trout-fly will probably not be seen. At about half tide, however, this game little fish will take a fly with alidity; and, if the angler cares to work for a heavy creel, as many as 40 to 50 Tiddlers may be caught within the space of a few hours. Experience has proved that a dark-coloured fly is the most killing lure, such as the trout butcher, grouse and clarat, alder, etc., but a winged fly would seem to be more attractive than a hackle, and in this connection it is interesting to note that a coch-y-bondu was absolutely despised.

The average weight of *fulviflamma* would be about three to the pound, but individual fish of $\frac{3}{4}$ lb. have been recorded; it may be accepted therefore, without overstepping the mark, that the maximum growth of the Tiddler would be about 1 lb., and on a trout cast and fly a fish of even half this weight gives the sportsman a magnificent fight. In angling for Tiddlers one final word of advice is tendered—beware of the hamur. While playing a fish a hamur may also be watching the fun from his den, in which case if opportunity offers he will assuredly dash out and seize it. If such an incident does happen it is extremely unlikely that the Tiddler or trout fly will ever see the light of day again.

The question will probably be asked whether none of the species mentioned in the list of surface-feeders will take a fly. Experiments in this direction were never carried out, so that there is no practical basis on which to establish such claims. Other authorities, however, aver that the gar-fish (kharkoor of the Persian Gulf) can be caught on a fly. There would seem to be no reason to suppose that such species as the Susansir, Zayipur, and small Saran should not rise to a salmon fly such as the Silver Doctor, or some other pattern that bears a shadowy resemblance to a white bait. In temperate waters the basses are fly-takers, and exploration in this field might prove that the "Surkhoo" or other species of genus *Lutjanus* would give the salmon angler the chance of keeping his eye and wrist in practice during the dog-days of enforced banishment in this Eastern Turkish Bath.

Let us now pass on to an examination of the characteristics of the last group of fishes in our table, viz., the

BOTTOM-FEEDERS.

It is self-evident that no really hard and fast line can be drawn separating the surface from the bottom feeders. The pirao is essentially a surface feeder yet an occasional individual fish will be recorded by the hook when bottom-fishing; similarly the giddie is one of the principal species caught bottom-angling though at times he will come to the gaff on a white bait. On the other hand, there are some species which, owing to the construction of their anatomy, and the range of their habits, are decidedly bottom-feeders. In the following pages we will confine ourselves to a review of those species which are unable, or which refuse, to take a white bait. The occasions on which the writer indulged in bottom-fishing were very rare, so that any dissertation on the relative sporting propensities of the different species will be omitted. It may be taken for granted, however, that all those catalogued are game fish, and will afford sport to the fisherman whose particular bent is this form of angling.

Just as we begin with the surface feeders, so it will be seen with the bottom-feeders that the family

CARANGIDÆ

The first caranx that presents itself for discussion is locally termed the
KUSH.

Caranx ciliaris (?)

The following description was recorded from a specimen weighing 4 lbs.

Head.—Deep and compressed, mouth on the smallish side, but capable of considerable protrusion.

Teeth.—Villiform on both jaws, palatines, and whole upper surface of tongue extending to gullet, both above and below.

Eye.—Large and protruding, iris yellow after death.

Fins anterior dorsal.—Six sharp spines connected with transparent membrane.

Posterior dorsal.—Commences moderately close to termination of anterior dorsal, rayed and continued by a connected fringe up to a point distant from the root of the caudal equal to space between anterior and posterior dorsal; the fringe terminates in a slightly elongated ray.

Pectoral.—Long, slender, narrow, delicate and graceful.

Pelvic.—Short and stiff and folding into a depression with anus situated at posterior end of this slot.

Anal.—Commences posteriorly to the anus at a distance equal to double the space between the anterior and posterior dorsals; the initial ray is long and flexible; the rays in the anal gradually shorten and the anal proper is continued towards the tail by a fringe similar to the posterior dorsal fringe; it terminates also in a slightly elongated ray.

Caudal.—Rayed and deeply forked.

Scales.—Absent.

Lateral line.—Starts at upper termination of gill opening in an ascending curve descending to a point on the centre line about $\frac{2}{3}$ length of whole body to fork of tail. It is ridged throughout, but becomes slightly keeled towards free portion of tail.

Body.—Deep and compressed.

Colour.—After death a band of steely blue commences above eyes and runs between lateral line and back up to caudal, broad at its commencement and tapering towards the tail. Above and below this band there is a space of brilliant iridescence. From the commencement of posterior dorsal to end of dorsal fringe, the space above this longitudinal band, is barred vertically from the base of each ray to the band with steely blue. Below longitudinal band and above lateral line there is a row of large steely blue spots. Between the lateral and centre lines there are steely blue markings. Above the anal fin and fringe is a longitudinal band and transverse bars similar to the dorsal band and bars.

Remarks.—The maximum weight to which this fish grows would be about 12 to 15 lbs.

The next caranx of which observations were noted bears the local name of

KOB DAR.

Caranx speciosus (?)

Weight of fish examined = $2\frac{1}{2}$ lbs.

The kobdar is very similar in appearance and conformation to the kush, but the following differences were remarked.

Head.—Much more convex.

Teeth.—Absent on jaws and palate.

Eye.—Relatively smaller and iris silver.

Marks.—The steely blue marks are similar to those on the kush, but in addition 7 broad bands run vertically from back almost to belly.

Colour.—There is more lemon yellow visible than on the kush, the cornea is tinged lemon yellow, likewise the cheeks, caudal, and all fins.

Remarks.—The maximum growth reached by the kobdar would be about 10 to 12 lbs.

Another caranx which is taken by the bottom angler is called by the locals

RUSHK.

Caranx armatus (°)

No actual notes were taken by the writer from a specimen of this fish, but almost every morning when the white bait nets were being dragged the rushk was obtained and these fish were casually examined and the prolongation of the first ray of the posterior dorsal was a feature that was particularly striking. The identification of these three species of caranx should be taken with reserve; but it is probable that the species to which they have been assigned will on further investigation prove to be correct. The rushk would attain a maximum weight of 12 to 16 lbs.

Although among the bottom-feeders the family of *Carangida* has been assigned the first place, by reason perhaps of the better sport which may be anticipated from its members, yet in point of weight of individual fish which will compose the average creel of the bottom-angler the family of

SQUAMIPINNES

will certainly play an important part.

Of this family the identity of one species has been determined; it is known locally as the

SHUNGGOO.

Drepane punctata.

With this fish the hackneyed expression "once seen never forgotten" is peculiarly appropriate, as the general appearance of the Shungoo stamps him as a freak of nature for which no adequate reason can be assigned. The appended description will furnish the reader with a fair conception of the oddities of *Drepane punctata*.

Head.—Very deep and compressed. In front of the eyes is a very hard, long well-marked prominence, which gives this weird fish the appearance of being beetle-browed. There is a second much less prominent bump vertically above the eyes.

Eyes.—Large and seated.

Nose.—There is quite a nose on this fish formed by a cartilaginous and bony plate which is continuous from gill plate to gill plate.

Mouth.—Is extremely curious. The mouth is quite small, but is capable of being protruded downwards to the extent of over an inch in a fish of 3 lbs. weight. The mouth of a shungoo of this size will just accommodate one's little finger. A hard pad is situated on both upper and lower surfaces of the gullet which is furnished with sharp teeth.

Teeth.—Villiform on a cartilaginous pad on upper and lower lips, crushing pad on palate and back of tongue.

First anterior dorsal.—Six sharp spines of moderate length, connected by transparent membrane; this fin fits into a socket. There are two short and sharp spines situated anteriorly to this fin which might be considered to form an integral part of it.

Posterior dorsal.—Rayed and very much developed, the outer fringe forming a convex curve, the rays near the tail being shorter than those at the commencement of the fin.

Anal.—Is similar to the posterior dorsal transposed, though the rays are not quite so long, but equally developed. There are three very sharp stout spines just anterior to anal fin. The root of the tail is very stumpy, but the rays of the caudal are very well-developed.

Caudal.—Straight cut, but convex in the centre.

Pelvic.—First spine is hard but not sharp, remainder rayed, a peculiar flap of cartilage like the point of a triangular bayonet comes out of the fin-pit.

Pectoral.—Very slender and long, the tip reaching to the base of the posterior dorsal fin—a black patch in the fin-pit.

Lateral line.—Convex curve from top of gill plate to root of tail and slightly ridged.

Scales.—Small-transparent.

Colour.—General colour silvery; the upper half of the fish (specimen examined weighed 3 lbs.) is marked with black spots about the size of those on a pound trout.

General appearance.—A very deep and compressed fish, almost as deep as it is long; a line from the mouth along the belly and the first anal spine is practically straight.

Remarks.—Day gives the local name of this fish as follows:—

Belooch, Shuk: Arrakanese, Shengnaroët; Burmese, Nga-Shengua. The similarity between Shungoo and Shengua (for “nga” in Burmese merely means fish) is most striking. Can it possibly be a mere coincidence that two countries situated so far apart as Burma and Persian Mekran should each call the same fish by a name that is almost identical? Such a contention is inconceivable. It is a problem that should be of more than passing interest to the Etymologist; more so as the intermediate Tamil and Telegu names bear no resemblance whatsoever to the Burma-Mekran root. The maximum weight to which the shungoo grows would be about 5 lbs.

Another fish which is extremely common in Jask waters is termed by the locals

SUNGSEER.

Holacanthus xanthurus (?)

The identity of this species has not been fully established, a detailed description of a specimen is therefore appended.

Weight.—3 lbs. 10 oz.

Length to tip of tail.—1 ft. 8½ inches.

Girth.—14 inches.

Head.—Is remarkable for a prominent lump a little distance behind the eyes.

Eye.—Large, iris iridescent, in some lights sky blue, in other lights olive-green, shot with yellow.

Teeth.—Villiform rows on the upper and lower jaws; they are entirely absent on the tongue and palate. The upper and lower portions of the gullet are composed of a moveable cartilaginous pad almost like very fragile and porous bone. These crushing pads support on their anterior edge an upper and lower strip of sharp villiform teeth. The remainder of both upper and lower pads is studded with hard conical teeth, some of which are more dome-shaped than conical. The inner edge of the gill situated anteriorly is furnished with soft projections (combings) surmounted by villiform teeth.

Fins anterior dorsal.—Composed of 8 very strong and stout spines widely separated and connected by a thin transparent membrane. The extremities of the spines are extremely sharp. Protruding anteriorly from the

base of the first spine are 2 thick sharp spines unconnected with membrane, that situated anteriorly is about $\frac{1}{2}$ an inch in length; the second is about 1 inch in length. The whole of the anterior dorsal folds down in a well defined groove in the back.

Posterior dorsal.—Commences immediately where the anterior dorsal terminates. They can be regarded as 2 distinct fins. Situated anteriorly is a single hard spine, followed by 14 soft rays in juxtaposition connected by a thin membrane.

Caudal.—Nearly square-cut, rayed and powerful.

Anal.—Posterior portion rayed and soft. Anteriorly are three spines, the first is a comparatively thin spine with an excessively sharp point. The second is an extremely thick and stout spine of moderate sharpness. The third is a sharp stout spine about $\frac{1}{2}$ an inch in length.

Pelvic.—Rayed and transparent, the anterior ray is continued for about $\frac{1}{2}$ an inch by a soft whitish filamentous piece of cuticle terminating in a delicate point. Anteriorly is situated a hard spine.

Pectoral.—Of moderate length, soft, rayed and transparent.

Colour.—Head iridescent, general colouring being olive green. This hue is carried along the back to the tail. The sides are silvery and iridescent, towards back olive green, gradually merging into light gold towards belly which is white. The colour of the tail is most distinctive. From anal fin to the commencement of caudal is bright gold which continues along bottom edge of caudal and terminates in a patch of colour between gold and orange $\frac{2}{3}$ of an inch deep by about $\frac{1}{2}$ an inch broad. The region of about 5th and 6th rays both on the upper and lower lobes of the tail are tinged pomegranate. The inside of the gill plates are remarkably coloured bright gold. The skin on the neck bordering the gills is an olive green turning into a bright gold where it merges into the mucous.

Scales.—Transparent and of considerable size. The head is scaled as far as the eyes.

Lateral line.—Well-defined curving upwards from the gill-plates and descending gradually towards the tail.

Remarks.—The maximum growth attained by the Sungser is probably about 6 lbs.

There is yet another bottom-feeder which figures largely in the catches of the villagers and he swims under the local name of

TENGUN.

Family undetermined.

The following description was most carefully recorded from a specimen, but all efforts on the part of the writer to settle the identity of this fish have signally failed.

This failure may be attributable to lack of accuracy in observing the specific points but in any event the notes as originally jotted down are here reproduced.

Body.—Extremely convex and deep.

Eyes.—Large.

Teeth.—Absent on jaws; hard crushing plates on upper and lower surfaces of gullet.

Fins dorsal.—Belt and rayed, fin proper is long and curved backwards, and continued to free portion of tail by a connected fringe.

Caudal.—Deeply forked and long.

Anal.—Situated immediately below dorsal; rays are not so long as those dorsal and continued backwards by a fringe similar to the dorsal

Pectoral.—Short soft and rayed.

There are no spines anywhere.

Colour after death. Flanks tinged with light gold from tail to head including gill plates; pectoral greenish yellow; pelvic distinct lemon yellow; anal and as far as anus, which is $\frac{1}{2}$ way between anal and pelvic, bright lemon yellow; fringes tipped yellow green; lower parts pomegranate; caudal tipped yellow green.

Lateral line.—Curved slightly upwards from gill plates and gradually descends to tail.

Scales.—Small, and skin thick.

Remarks.—The tengun's maximum weight would be about 6 lbs.

Let us now proceed to the investigation of a variety of sea-fishes which is familiar to most of us by name both in temperate and tropical waters. Reference is made to the breams. Day divides the family of

SPARIDÆ

into 6 genera, of which two are represented at Jask. The most common genus is

PAGRAS,

and this genus possesses only one individual species in Indian waters which is locally termed the

COOPER.

Pagrus spinifer.

The following description will serve to fix the identity of this bream.

Weight.—5 lbs.

Length.—From tip of nose to cleft of fork in caudal 1 ft. $7\frac{1}{2}$ inches.

Head.—Large. There is a characteristic protuberance in some fish on the median line between the eyes. According to local report this bump is peculiar to the male fish.

Eyes.—Large.

Teeth.—Two rows of conical teeth on either side of both the upper and lower jaws. In addition 4 conical incisors in front on both jaws absent on palate.

Fins dorsal.—Is divided into two portions; anterior portion consists of 10 spines connected with transparent membrane, the posterior portion consists of 10 connected rays.

Caudal.—Forked, span about equal to $\frac{1}{2}$ of length of fish.

Anal.—Three spines anteriorly remainder rayed.

Pectoral.—Narrow and remarkably long; first spine which is exceedingly stout almost equals span of caudal.

Pelvic.—Narrow and slightly more than $\frac{1}{2}$ span of caudal.

Lateral line.—Is well-defined.

Scales.—Small and transparent.

Colour.—The head has a gilt sheen overlying a pinky red hue, which extends along the back to the tail; the dorsal and caudal is edged brick-red.

Remarks.—The cooper is only a cold weather visitant to Jask, and when the angler happens to strike a shoal the fun is fast and furious. The maximum growth to which this fish attains is probably 15 lbs., but a 10 lbs. fish is a fine specimen. On occasions when the report spread that the coopers were in, a party of anglers would organize an outing in the outer bay; the picnic would also be enlivened by the presence of eight or ten coopers in their dug-outs. The capture of a cooper was known to one and all by the sound of its being banged on the head with an approved "papat."

After dark when sport was slack the members of the party in the cutter would amuse themselves by beating one of the cushions violently every few minutes! This continual hammering was usually a sure "draw" for the locals. One by one they would up anchor and row in closer to the cutter until it was ringed with a circle of dug-outs. The hoax would then be disclosed, and the victims would join heartily in the general laugh! The party in the cutter, which would probably comprise as many as 9 hand-lines, would frequently bring back during an evening's jaunt between 30 and 40 coopers, averaging from 5 to 6 lbs. each.

The second species of sea-bream which the bottom-angler may encounter is a member of the genus *Chrysophrys*, and in local parlance is the

DUKH MULLAH.

(Mullah's daughter)

Chrysophrys haffara.

The following description was taken from a specimen weighing 1 lb. 9 oz.

Head.—The median line from nose to fore-head is straight, neither convex nor concave.

Mouth.—There are distinct upper and lower lips which are non-prehensile.

Teeth.—Are characteristic; at extremities of upper and lower jaw are four conical incisor-teeth placed at the same angle as those of a rodent or very old horse. They are of considerable length and thickness and are set in tissue resembling very much the gums of a human being. On each side of the upper jaw are four rows of dome-shaped crushing teeth, and 3 corresponding rows on each side of the lower jaw. The gullet is provided with a pad above and below supporting sharp villiform teeth.

Eye.—Large, immediately in front of each eye is a prominent bump; iris bright gold.

Fins—dorsal.—Consists of one fin divided into two portions. Anterior portion is composed of 11 exceedingly sharp and strong spines connected by transparent membrane, the first is very short, the second is also short and about $\frac{1}{2}$ the length of the third spine; the remainder are prominent; the anterior portion fits into a groove in back.

Pectoral.—Rayed and of medium length.

Pelvic.—Of considerable size, rayed, except exteriorly where there is a strong, hard and sharp spine.

Anal.—Consists anteriorly of one small sharp spine, followed by a long and very stout sharp spine, and a third spine not so stout, but equally sharp. The remaining portion is rayed.

Caudal.—Forked and rayed.

Colour is distinctive. A broad splash of bright gold under each eye connected across bridge of nose by bright gold band; dorsal fin bright gold; caudal orange tipped with bright gold. Pelvic fin is black, streaked with milky white; posterior portion of gill-plates bluish-black; sides and belly a net-work of bluish-brown on a milky white back-ground.

Lateral line.—Curves upwards from top of gill-plate and gradually descends to tail: it is very slightly ridged.

Remarks.—This fish is by no means common. Like the cooper its flesh is excellent for table purposes. Its maximum growth would probably be about 6 lbs.

We have now arrived at the last family on the list of bottom feeders, viz., the

PERCIDÆ.

Of this family two genera are represented, each by one individual species. The first species termed locally the

KHER.

Lutjanus roseus.

Has already been described in works dealing with Indian fishing; a repetition will therefore be eschewed. The kher is very similar in colour and conformation to the surkhoo—*Lutjanus argentimaculatus*—but it can be distinguished readily from the former by reason of its rounded caudal, the caudal of the surkhoo being forked. The following measurements were recorded from a specimen caught by a local in his net.

Weight—38 lbs.

Length—3ft. 9½ inches.

Girth—26½ inches.

The maximum weight to which the kher attains would probably be about 60 lbs.; it will be seen therefore that this species grows to much larger dimensions than its congener the surkhoo.

The second bottom feeding perch bears the local cognomen of

BAHILOOL.

Serranus miniatus.

Mouth.—Lower jaw is under-hung and powerful.

Teeth.—Extremity of lower jaw is furnished with 2 sharp conical teeth, the upper jaw is similarly provided but the pair of conical teeth are somewhat separated.

Both upper and lower jaws support several rows of formidable villiform teeth, a cluster of similar teeth on the vomer, absent on tongue which is well developed. There are small villiform teeth on both surfaces of the gullet and on the gill fringes.

Eyes.—Small, sunk, iris tinged with gold.

Fins dorsal.—Is divided into 2 portions; anterior portion comprises 9 stout sharp spines connected by transparent membrane; posterior portion rayed and markedly pointed at its extremity.

Anal.—Immediately below posterior portion of dorsal and similar to it in character; anteriorly 3 stout spines.

Pectoral.—Half fan-shaped.

Pelvic.—Immediately below pectoral, exteriorly 1 hard spine.

Caudal.—Long, rayed and rounded.

Scales.—Small.

Lateral line.—Slightly ridged.

Colour.—Jaws, inside of mouth, and tongue deep crimson; general colour of body red—dorsal, anal and pelvic edged with crimson; pectoral crimson edged with a broad band of orange; whole of body, head, caudal and anal speckled with pale blue spots.

Remarks.—The maximum growth of this species would be about 5 lbs. It cannot be considered common in Jask waters.

With the bahilool terminates our investigation of the bottom feeding game fishes of these latitudes. There is a question, however, on the tip of the tongue of the angler who has heaved a lead over the gunwhale on a summer's night off the coast of the Emerald Isle. Do the waters of the Persian Gulf harbour any of the skate family? In parliamentary language the answer is most emphatically in the affirmative. But when all is said and done can a skate be appropriately admitted to a place in the piscine aristocracy? Hardly so—although in some localities in the western hemisphere fishing for skates is included in the realms of "sport." In any event the skate or *pao* is present in swarms and any estimate of his maximum weight is pure guess work.

One sportsman is credited with a fight of some 6 hours duration with a monster skate; at the end of which time the line parted. 200 lbs. would

certainly be no exaggeration. Before leaving the subject of the *Trygonidae* one word of caution is offered. In handling a skate let the novice be exceedingly careful of the spine below his whip-cord of a tail. A prick from this weapon of defence, and he is an adept in its use, may develop into an exceptionally unhealthy sore. In addition to the skate the creel of the bottom-angler may be varied by the capture of an occasional *soos* (family *Rhinobatidae*) familiarly known as the "ground shark"; and as for the "gulloo" or cat-fish, the angler is frequently obliged to up-anchor and change his venue to avoid the unwelcome attentions of this scavenger of the seven seas.

Up to the present only the game-fishes of Jask have been introduced to the prospective angler. Let us take a tour, on paper, round the Persian Gulf and delve, metaphorically speaking, into the delights of

OTHER FISHING RESORTS

and see what treasures live beneath the surface of this vast arm of the Indian Ocean. Starting from Karachi and skirting the coast of British Mekran the prow of the packet is headed for

ORMARA.

During the cold weather months, sport in the waters of Ormara is reported to be of the first quality, the principal fish being the surmai or seer. There is a tale told in the Gulf ports that a gigantic surmai leapt into the boat of a local fisherman, and striking the unfortunate wretch with his jaws in the pit of the stomach disembowelled him. Such a legend may savour of the proverbial fisherman's yarn, but anyone who has examined the mouth of a large surmai can readily imagine that it is not entirely beyond credence.

Pasni and Gwadar are the next ports of call on our voyage of discovery, but no definite information is forthcoming concerning their potentialities for sport with rod and line, though dried fish and sparks' fins would seem to form the main items of export. In normal times the slow mail will next drop anchor in

CHAHBAR BAY,

a large indentation in the coast of Persian Mekran.

The fishing at this tiny little British settlement, it must be admitted, is disappointing; saran there are during the hot months, but round the shores of the promontory they require a very large amount of coaxing. From local information it has been gathered that on the opposite side of the bight a distance of 8 miles, lie the favourite haunts of the saran, but the accuracy of this statement still requires to be put to a practical test. Passing the low-lying promontory of Jask, where the 100 fathom line curves within 3½ miles of the Cape, we steer to the mouth of the Persian Gulf proper, and drop our anchor at

HENJAM,

a small island about half way along, and lying close to the southern shore of the larger island of Kishim. In the Straits fish are to be caught though of what variety there are no authentic records; and in this connection the sportsman will have to take precautions as the tides run strong. Bunder Abbas, Linga, Bushire are other ports on the Persian Littoral, and the Shatt-el-Arab at the head of the Gulf has become famous within recent times. Still continuing round the Arab coast, we may touch at Bahrein, the centre of the pearl industry, and continuing over the Great Pearl Bank, we again pass into the tidal race at the head of the Gulf of Oman and emerge in one of the fjords of the

MUSANDAM PENINSULAR.

It is a problem which scientific research can only solve whether the true pelagic fishes enter the Persian Gulf proper or not. The author's personal opinion is that the limit of their western migration is the Peninsular of Musandam. Enquiries have been instituted, and omitting Bushire the ports mentioned have all been visited on two separate occasions at an interval of 26 months. In no single instance were there any indications that the great families of pelagic fishes penetrated into these regions. Is there any solid foundation on which this hypothesis can be based? A glance at the chart of the Persian Gulf proper will demonstrate the fact that, with the exception perhaps of one hole in the sea-bed south of Tanb Island, there are comparatively few soundings of over 50 fathoms, throughout the length and breadth of this enormous basin. Contrast this actuality with the condition that obtains in the Gulf of Oman. At a point 6 miles south-east of Cape Jask the sea-floor has sagged to a depth of nearly 1,400-ft. It has already been remarked that the pirao when hooked over this shelf *invariably* heads for the open sea. Is not this settled impulse proof positive that, in the throes of his struggle for life, instinct is driving him to seek refuge in his true home—the mighty deeps? Is it at all reasonable to contend then that he will voluntarily abandon this *habitat* assigned to him by nature and migrate into a comparatively shallow trap which the same nature by intuition tells him is but a blind alley? By some sceptics such notions may be labelled “fantastic”. Does any one but a bigotted atheist deny that some power guides the fowls of the air in their annual migrations? Does not this self-same power then also pilot the fishes of the sea in *their* yearly migrations? But let us conclude our voyage by dropping anchor at

MUSCAT.

From the deck of the steamer, as we approach this port, the eye that is geologically inclined will discern at once that the Sultan's Capital is situated practically in the centre of what was at some prehistoric era a terrific volcanic upheaval. The crumbling slopes of the jagged barren bluffs drop sheer down into abysmal depths below. The fishing-grounds—and this expression is no Irishism—lie not in the harbours of Muscat and Muttra—few healthy game fish would frequent those polluted road-steads; the haunts of the true pelagic families may be looked for some three miles off shore. In these marine labyrinths the locals bottom-fish and *catch surmai* at an approximate depth of 60 fathoms! Here also roams the *geedur* of 100 lb. and the *sewa* and a host of other game fishes, whose identity is as yet undetermined. But lord of all these finny creatures is the world-famed sword-fish. There are records to shew that this Goliath has been hooked on rod and line, but unless the deeds of bygone anglers are being overlooked, never yet has this mammoth been brought to gaff by a western angler. “Tis better to have hooked and lost than never to have hooked at all” is perhaps some consolation to an angler, as it is reputed to be to the love-sick swain who has just been the recipient of a broadside from a super-virago. Still—the thought is bound to rattle—“if only I had ——— etc., etc.” The day may yet dawn, however, when the record for the heaviest fish caught on rod and line in Indian waters may pass over the Gulf of Oman from Jask to Muscat.

From the foregoing dissertation the prospective angler should have derived a comprehensive idea of the sport that awaits him in the waters of the Persian Gulf. Let us therefore pass on to a consideration of the three remaining problems that were enunciated at the commencement of this paper.

METHOD TO BE ADOPTED.

SURFACE-FEEDERS.

For the surface feeders trolling is undoubtedly the best method of securing sport. The line should be marked with silk at every 50 yards, and 50 yards should be let out behind the boat. No lead is necessary or desirable, certainly within the 15 fathom line. The pace should be just as fast as the boat can be rowed with comfort. If a fish has touched the bait and dropped it, do not stop the boat. Carry on for a short distance and if nothing further happens keep the boat in motion and reel up slowly. As the lure approaches the craft it will skim along the surface of the water; frequently this particular motion proves an irresistible temptation to the procrastinating rover. A final word of advice is tendered. Never under any pretext whatever, put the rod down in the boat while the bait is overboard. Such a procedure is merely steering a deliberate course to ultimate disaster.

BOTTOM-FEEDERS.

For bottom-fishing paternostering is the most efficacious method, and two booms are recommended, with a large specially designed sea-float. In this form of angling local knowledge is paramount. Each variety of fish must be wooed in its own special location. It is perfectly useless anchoring over the *sungser* beds and hoping to catch *coopers*. It is equally futile rowing out into the void and expecting to catch anything. The villagers have the different areas mentally fixed by crosscuts on prominent land marks. It is necessary either to engage one specially as guide and philosopher, or the other alternative is to join the merry throng that goes singing along somewhere about 2 a.m., and drop anchor in close proximity to the general conclave.

The third subject that presents itself for discussion is the question of

LURES.

It is a matter of common-sense to suppose that the natural food of the larger predacious fishes, if persented in a scientific manner, is likely to prove a far more deadly attraction than any manufactured imitation. It can therefore be readily deduced that an artificial lure should only be employed when natural bait is not procurable, or when the stock has become exhausted. It may be argued that difficulty will probably be encountered in procuring such natural goods; but this contention is not applicable to the Persian Gulf. Arrangements can always be made with one of the villagers, and such will include the provision of a locally-made cast net of suitable mesh.

The natural *pabulum* of the surface-feeders consists of the minnows of the class *pieces*; the varieties most commonly obtained will be described in detail.

MULLET.

Experience has proved that for general utility and in its killing properties the family of *Mugilidae* stands unrivalled. Of the mullets three species are common at Jack.

Boi (pronounced "bo-i")

The bo-i is a tough silvery fish, which does not grow beyond about 7 inches in length, and can be distinguished by its comparatively narrow head, and by the fact that the posterior portion of the iris is coloured black. It is in spawn in December.

BI-ACH.

The bi-ach (the "ch" being pronounced as in "loch") attains a maximum weight of about 4 lbs., but the smaller specimens up to 10 inches in length are suitable for bait. The bi-ach can be recognised by its broader and flatter head, and by the absence of the gold on the iris; its scales also differ from those of the bo-i being larger and coarser.

PITT.

This species of mullet is probably *Mugil waigiensis* and would grow to 10 lbs. at least in weight. One specimen of 7 lbs. was weighed and examined, and its measurements are quoted as such may prove of technical interest.

Length.—2 ft.

Girth.—14 inches.

In general colour the mature pitt is India-rubbery on back and sides, belly dull white and the pectoral is black. In the fry, however, the tone is much more silvery and the sides are marked with bands longitudinally. For purposes of bait however fish over 10 inches in length should be discarded.

TIR-MUKNA.

Occasionally the tir-mukna is taken in the cast net of the bait-catcher in company with the mullets and when, the angler can count one among his baits he may consider himself in luck's way. This fish is the "milk-fish" or "white mullet" of the Europeans in South Canara—family, *Clupeidæ*; species, *Chanos salmoneus*. The habits of this species are most remarkable. At certain seasons of the year the waters of the Persian Gulf are covered by extensive patches of a brick-red scum, about the origin of which there are several theories. In this scum shoals of large tir-muknas, up to 15 or 20 lbs. in weight, are frequently observed. On many occasions they were watched most carefully by the writer at close quarters from his dinghy. They swim about with their backs above water, and mouths wide open. It was a most striking phenomenon to see a wide-spread pair of cherry lips suddenly appear above the surface; in fact at times the apparition was quite uncanny. One can readily imagine how the mariners' tales of mermaids may have received their origin!

MORAN.

In the early pages of this paper the moran received cursory attention, and a promise was given that a description would be recorded in due course. Appended is the genealogical tree of the moran; family, *Scombroseidæ*; genus, *Hemirhamphus*. In Jask waters two individual species are met with, viz., *Hemirhamphus georgii* and *Hemirhamphus far*. Both species are somewhat similar in appearance, but *H. far* is deeper and is marked with 4 vertical black blotches on its sides which do not extend below the lateral bar; moreover in *H. far* the upper lobe of the caudal is bright yellow which characteristic is absent in *H. georgii*. *H. far* is solely a cold weather visitant; it vanishes with the advent of *H. georgii* to spawn in March. The conformation of the moran is unmistakable. The body is elongated and cylindrical and a longitudinal bar like quick-silver runs from gills to tail. The lower jaw of the moran is prolonged into a mandible very similar to that of a jack snipe. When some dozen specimens of a single variety of fish are used daily as bait for six months continuous fishing it must be acknowledged that a wide scope for observation has been acquired. At first the function of this mandible was not apparent, but

when several individual fish were most carefully examined, and a slater-like crustacean was actually revealed in the process of being swallowed, its use became intelligible. The mandible is evidently employed for excavating the prey from the sand or perhaps from holes and crannies in the rocks. The mandible of *H. far* is shorter than that of *H. georgii*. The pace at which the moran travels in its aerial flights is scarcely conceivable. In the spawning season while the turmoils, which have already been alluded to are at their zenith, the moran is driven into a state of blind panic. It is possible that when it is indulging in one of its atmospheric excursions the sense of vision becomes exceedingly restricted, if not actually eliminated, for it will invade the boat in swarms. The velocity with which a moran strikes the angler in the neck, arms or chest cannot be realized until it has been experienced; and in this connection the fisherman is in some danger. A blow in the eye from the mandible of a moran would unquestionably cause the loss of that organ. The author can certify that a case was admitted to hospital in which a sepoy while bathing had the drum of his ear perforated by the flexible mandible of a moran.

From March to August or September the moran forms the standard bait as the mullet is somewhat difficult to procure.

SARDINE.

At Muscat the sardine is the bait most commonly used, and it attains a considerable size; on the Mekran side of the Gulf of Oman, however, this lure is not employed unless all other species of natural baits have proved unprocurable. It possesses one great disadvantage as a lure, in that its flesh is soft and in consequence it is easily torn off the hooks.

FLYING FISH.

The last of the lures for the surface feeder is the flying fish; but it is pure chance whether a specimen is secured or not. This lure is naturally more effective in the open sea than it is on the shallows.

BOTTOM-FISHING.

The lure available for bottom-fishing is of two varieties. A small fish like an anchovy is that most commonly employed, but it can be alternated by the use of the ordinary

CRAB.

Two varieties of crab can be obtained; the rock crab is of a dark-green hue, and is tougher than his brother the sand crab whose garb is a dirty yellow. However, it is one thing to have a crab in a can, it is quite another thing to transfer it successfully to a hook. The manoeuvre is an art in itself and merits description. At the time of capture all the legs are broken off except one on each side. This drastic operation serves two useful purposes. It keeps the wretched victim alive, and it also prevents it effecting its escape. At the time of use the two remaining limbs are torn off; then the point of the hook (size No. 1/0 is suitable) is inserted in each stump in turn, which is wrenched bodily out of the socket. The mutilated carcass is then heaved overboard!

If nothing else served to put any decent-minded angler off bottom-fishing surely this barbarous practice should suffice!

There now remains but one point for discussion and that is the question of

TACKLE.

It is a most astounding fact that if a prospective purchaser enters almost any shop, and asks for sea-tackle, he will be shown what can only be described in two words *Assorted Rubbish*. One can only

marvel why such down-right trash is ever manufactured, but presumably a market for it *does* exist, otherwise the trade would die a natural death.

Quite recently a nephew of the writer, *ætat* 10, sent him a calendar inscribed with the following moral:—

"*Keep your temper, it is worth more to you than anyone else.*"—The probable outcome of the next meeting with this self-same nephew is no fit subject for this paper! However, this excellent precept is passed on to other followers of the Gentle Art, not from any personal motive, but purely with the object of emphasising the fact that if the angler in the Persian Gulf wishes to keep his temper and *enjoy* his sport he must rigidly eschew the purchase of any of the rubbish that is proffered under the title of "sea-tackle." There is nothing so trying to the temper as being broken by every heavy fish. The advice therefore is tendered unequivocally, and it is based on the experiences gained from nearly 2 years of continuous angling—buy the best tackle that is to be had in the market. This plan, if adopted, will prove far less expensive in the long run, and the pleasure derivable from *catching* fish instead of *losing* them will amply repay the extra expenditure involved in the original outlay. From October to April inclusive heavy tarpon tackle is essential to success, whereas from May to September light tarpon tackle will prove sufficient to ensure the angler his much coveted and proverbial

TIGHT LINE.



THE BUTTERFLIES OF LAHORE

BY

G. W. V. DE RHE-PHILIPPE, F.E.S.

In recent issues of the Journal, we have been given papers on the Birds of Lahore and on the Earthworms of Lahore. The butterfly collector is not much in evidence in the Punjab plains; but a list of the *Rhopalocera* to be found in Lahore, and its immediate vicinity may find interested readers, and will serve as a reference and aid to anyone who may wish to take up the study in the future.

The list is not a long one. For some months of the year—May to July and even later—the climate is exceedingly hot and dry, while a heavy and almost continuous dust haze lies over everything; and the winter months can be very cold. Conditions such as these are anything but encouraging to butterfly life, and it is only for a few weeks in September, October and early November, that these insects show up in any real numbers. For the remainder of the year they are either absent altogether or are represented by stray individuals of the more common and widespread species.

Under these circumstances, it is not surprising that so little attention has been paid to the Lahore butterflies. And yet, scanty as they are, they possess an interest of their own. Lahore was, not so very many years ago, a very dry sun-baked district; and the butterfly fauna had probably a close affinity to the types found in the desert tracts to the south-west. The spread of irrigation in the last decade or two has brought more humidity into the climate; and, while the old affinity to desert types still persists in some directions, it is not improbable that the changed conditions will, in course of time, facilitate the spread westwards of some of the species characteristic of the damper country to the south-east. We already have one or two not usually connected with a very dry habitat; and it may be that a local list compiled, say twenty years hence, will show a yet further change in the character of the butterfly fauna.

I may explain that the list below refers only to Lahore and its immediate neighbourhood, to which my collecting and observations during the last four years or so have been restricted. It may, however, be taken as typical of most of the eastern and central Punjab districts outside the influence of the submontane country to the east and north-east and of the pure desert to the south and south-west. The country consists of a flat alluvial plain, cut up at intervals by the rivers and their spill channels. The greater portion of the culturable land is under crops. Waste land is

covered with scrub jungle—*Capparis* and *Salvadora*; and the trees (other than those introduced into gardens and plantations) are mostly the Tamarix, Sissoo, Acacia and occasionally a *Zizyphus*. Among garden shrubs which flourish and which are affected by the insects, either in the larval or the imago stage, may be mentioned the Oleander (*Nerium*), species of *Citrus*, the *Duranta* and a plant with white jasmine like flowers much used for hedges.

The list gives fifty-four species actually recorded; and mentions another fifteen or eighteen which should be or may be found to occur. The numbers quoted are those against which each species appears in Bingham's "Fauna of India" and in deNicéville's "Butterflies of India, &c."

NYMPHALIDÆ.

Sub-family—*Danainæ*.

As may be expected, this sub-family is poorly represented in the dry Punjab plains. Only four species appear.

1. *Danaïs plexippus*, Linnæus. (6 Bing.; 31 deN. as *genutia*). Is not rare in years when there is a good monsoon. It appears, as a rule, in July, and is on the wing throughout August and early September. A very occasional, and usually damaged, specimen may sometimes be seen during October, but after this the species disappears completely till the following rains.

2. *Danaïs chrysippus*, Linnæus. (8 Bing.; 28 deN.). To be seen throughout the year. Is very common during the rains and autumn, and only slightly less so in the winter. One or two may even be seen in the very hot months before the monsoon.

The variety *D. alcippus*, Cramer. (29 deN.) is to be taken but is extremely rare; the dimorphic form *D. dorippus*, Klug. (30 deN.) may possibly extend to the district, but I have not yet seen it.

3. *Danaïs limniace*, Cramer. (12 Bing.; 26 deN.). Appears at very much the same time as *D. plexippus* and is favoured by the same conditions. The species disappeared almost completely in 1915, but this was an extraordinarily hot year without rain. It was, on the other hand, exceedingly common in July and August 1916, which were unusually wet months. Is very fond of the flowers of the *Duranta*.

4. *Euplaea core*, Cramer. (31 Bing.; 61 deN.). Appears with *D. plexippus* and *D. limniace* and is nearly as common. An occasional specimen may sometimes be seen well into the cold weather.

Sub-family—*Satyrinæ*.

The conditions of the locality do not suit the sub-family and it is almost completely absent. Only two species have been found and individuals are scarce.

5. *Ypthima indica*, Hewitson. (172 Bing.; 214 deN.). Very rarely seen, only two specimens being recorded, one in June and one in November. May possibly be more plentiful in favoured local spots.

6. *Melanitis ismene*, Cramer. (191 Bing.; 249 deN.). Very erratic in its appearances and not common then. My notes of the four years' observations show that a few were seen in 1913, one in 1914, none in 1915, while it was comparatively abundant in 1916. It is on the wing for a very short time only in August or September, and is markedly crepuscular in its habits.

The only other species of the sub-family at all likely to be found in the locality are *Mycalopsis perseus*, Fabricius. (53 Bing.; 96 deN.), *Orsotricena meda*, Fabr. (72 Bing.; 92 deN.) and *Ypthima asterope*, Klug. (173 Bing.; 213 deN.). I have, however, not come across any so far.

Sub-family—*Nymphalinae*.

The sub-family is fairly well represented. The species are those usually found all over the plains in Northern India and individuals of each are, for the most part, common.

7. *Euthalia garuda*, Moore. (302 Bing.; 514 deN.). Only a single specimen—a female seen in September—has to be recorded and the species is apparently very rare in the locality. It was, as might be expected, the dry tract type I described in the 'Notes on some Butterflies from the Indian region' (Journal of the B. N. H. Soc., Vol. XX, page 759). The species will possibly, in the course of time, extend more commonly into the district from the west; and should probably be found more plentifully in places where the mango, on which the larva feeds, is grown.

8. *Junonia lemonias*, Linnaeus. (371 Bing.; 347 deN.).

9. *Junonia orithya*, Linnaeus. (372 Bing.; 350 deN.).

10. *Junonia hierta*, Fabr. (374 Bing.; 349 deN.).

11. *Junonia almana*, Linn. (375 Bing.; 344 and 345 de N.).

All the above four *Junonias* are more or less abundant in Lahore from July on till towards the end of the cold weather, frequenting gardens and open spaces. *J. orithya* and *J. hierta* appear, as a rule, rather later than the other two, never being much in evidence till the rains are well over. *J. hierta* is always the least common of the group; the other three are often to be seen in considerable numbers towards the end of and just after the rains, and stray specimens may be taken even in the coldest months.

12. *Vanessa cardui*, Linn. (376 Bing.; 520 deN.). The 'Painted Lady' appears regularly each year about the middle of November and is common throughout the cold weather, disappearing in February or March. It frequents gardens and open ground, and is particularly fond of flowers, chrysanthemums and yellow cosmos being always a great attraction.

13. *Hypolimnas bolina*, Linn. (397 Bing.; 419 deN.). This beautiful butterfly is comparatively common, being in flight only during the monsoon months, July to September and early October. Lahore specimens are invariably smaller than those found in the damper country of Bengal and the United Provinces; and the males always have light blue and white patches, the variety with very dark blue markings never being found.

14. *Hypolimnas misippus*, Linn. (398 Bing.; 420 deN.). Is distinctly less common than the last and has to be looked for. It appears later and remains on the wing a much shorter time. I have taken only one—the ordinary form of female, but the other mimicking *D. dorippus* possibly also occurs.

15. *Atella phalaena*, Drury. (416 Bing.; 314 deN.). Never found in the abundance one is accustomed to elsewhere, but it appears regularly and several may be taken any year between August and early November.

It is not improbable that, in addition to the above, which have been actually recorded, an occasional specimen of *Argynnis hyperbius*, Johanssen. (435 Bing.; 421 deN. : as *nigra*, Linn.) may also be picked up.

PAPILIONIDÆ.

The family is represented by three species only. One occurs very rarely, but the other two are common.

16. *Papilio aristolochia*, Fabr. (490 Bing.). Occurs but is very scarce. I have only seen one or two specimens each year, always in the same months.

17. *Papilio demoleus*, Linn. (507 Bing.). Exceedingly common for the greater part of the year. It becomes scarce only for a few weeks during the very hot and the very cold months.

18. *Papilio polytes*, Linn. (= *P. pammon*, Linn.). (522 Bing.). Males appear about the time the first monsoon rains fall in July and gradually become common. Females are usually much later, seldom being in evidence before late August. The brood seems to die out by the end of October, though a few ragged specimens may sometimes be seen as late as the third or even fourth week of November.

PIERIDÆ.

A family more strongly represented than any other in this part of the Punjab. The species are fairly numerous and individuals of most are common, so that a large proportion of the insects to be seen at any time are always of this family. It is only during the blazing hot and hazy weather of late May and June, when hardly a butterfly is to be seen, that these whites are scarce.

19. *Delias eucharis*, Drury. (571 Bing.). I took a very battered specimen in August 1916—the only one seen during the four years. The species is common to the south-eastward and may yet extend more freely into the district in years to come.

20. *Anaphæis mesentina*, Cramer. (581 Bing.). One of the most abundant butterflies seen in and around Lahore during the cold weather. It appears about November and is common everywhere till February or March, may be seen in thousands in the scrub bushes alongside the Railway.

21. *Pieris brassicæ*, Linn. (590 Bing.). Another cold weather insect. Appears in November and is common during the few weeks following. Partially disappears in the very cold weather, to come out again for a short time in January and February.

22. *Hypophina phryne*, Fabr. (604 Bing.). This dry tract form of *H. nerissa*, Fabr., is occasionally taken, but is rarer than might be expected. It is probably overlooked by reason of its general resemblance, when flying, to the more common *A. mesentina*.

23. *Irias marianne*, Cramer. (608 Bing.). Very rarely in the monsoon months, July to September. There seems to be no reason why it should not be more plentiful.

24. *Appias libythea*, Fabr. (610 Bing.). A few may be seen, usually in the period between the end of the rains and the setting in of the cold weather. Never common, but it is possible that a superficial likeness to other Pierids results in their being overlooked.

25. *Catopsilia crocale*, Cramer. (622 Bing.). Both this and the variety *C. catilla*, Cramer, are common throughout the monsoon and autumn months when it swarms round the flowers of the *Duranta*. A few may be seen during the winter and early spring, but it is never common after October.

26. *Catopsilia pyranthe*, Linn. (623 Bing.).

27. *Catopsilia florella*, Linn. (624 Bing.).

Both of these are common, appearing about the same time as *C. crocale*, but in special abundance just after the rains.

28. *Colias fieldi*, Menetries. (638 Bing.). Not uncommon in the early cold weather months. Is also to be seen in February and March.

29. *Terias libythea*, Fabr. (640 Bing.). A few may generally be taken in October-November. The species was unusually abundant for a short period in the autumn of 1914.

30. *Terias leta*, Boisduval. (641 Bing.). Only one or two have actually been taken, in October after the rains, but the species is probably more

common than these limited captures would indicate. It is not always easy to distinguish between the various species of the genus when in flight, and *leta* is possibly often overlooked.

31. *Terias hecabe*, Linn. (643 Bing.). Always the most common of the group. To be seen flitting round hedges and about grass country between August and November, and the species never quite disappears till the end of the cold weather.

32. *Colotis amata*, Fabr. (648 Bing.). The form *C. calais*, Cramer, is to be found almost throughout the year, commonly between July and November, less frequently but always fairly regularly from November till April or early May. As a rule, flies low, close to the ground, and is difficult to see.

The form might well be treated as a separate geographical race of *amata*. It is appreciably distinct from the parent form and is very constant in its facies.

33. *Colotis protractus*, Butler. (649 Bing.). Never really common, but an observant collector would generally take a few, in suitable spots, between September and November. It is somewhat irregular in its appearances; and, till it has been taken and recognised in flight, is apt to be mistaken for the yellowish wet season form of *C. vestalis* which is very common.

34. *Colotis vestalis*, Butler. (651 Bing.). Exceedingly abundant during all but the very hot dry months of May and June, when it disappears, and during the cold of December and January when it is scarce. Very much addicted to flying in and out of and about hedges of *Duranta*, *Dodonea* and other shrubs.

35. *Colotis fausta*, Olivier. (652 Bing.). Very rare. Only a single capture recorded (October).

36. *Colotis citrida*, Boisduval. (654 Bing.). Appears between August and December. Is comparatively scarce in the gardens in residential Lahore, but fairly common about the shrubs in the open country round. I noticed the same avoidance of habited localities in Oudh (see note on the Butterflies of the Lucknow district, Journal, B. N. H. Soc., Vol. XIV., page 492).

In addition to the above actually recorded by me, the following may also occur:—

Irias pyrene, Linn. (606 Bing.). Should occur; and even if it does not, at present, might establish itself. It is common to the south-east, conditions in the Punjab are not unsuitable, and the food plant of its larva, *Capparis sepiaria*, is found everywhere.

Terias venata, Moors. (639 Bing.). Has been recorded from 'the Punjab.' I have looked especially for it in Lahore, so far without success.

Colotis phisadia, Godart. (650 Bing.). Has been taken at Multan to the south-west, and there is a chance of its being found nearer to and in Lahore. The records of its occurrence anywhere in India are, however, very scanty.

Parnassia hippia, Fabr. (659 Bing.). Common further south-eastward; and as the food plants of the larva (varieties of *Capparis*) abound and conditions are otherwise generally suitable, the species will probably yet be found.

LYCENIDÆ.

The 'blues' to be found in Lahore and its neighbourhood are a poor lot. All belong to the *Lycenise* sub-family, and are, for the most part, only of the very common and inconspicuous species. None of the other sub-families are represented at all, though one might expect to find some of the *Argynnis* group and perhaps a *Rapala*.

37. *Zizera maha*, Kollar. (721 Bing.; 694 deN.). Fairly common from July to November. Flies low about grass lands.

38. *Zizera lysimon*, Hubner. (722 Bing.; 699 and 700 deN.). Is probably the most common *Lycænid* in Lahore. Occurs practically throughout the year, except the few very hot weeks of May and June, and is abundant towards the end of and after the monsoon when it swarms about grass and small flowering shrubs.

39. *Zizera gaika*, Trimen. (723 Bing.; 702 deN.). One or two have been taken, but it is by no means common. Occurs in August and September.

40. *Zizera otis*, Fabr. (724 Bing.; 703 deN.). In September and October but never common.

41. *Azanus ubaldus*, Cramer. (725 Bing.; 707 deN.).

42. *Azanus uranus*, Butler. (726 Bing.; 708 deN.).

I have only taken two or three of each of these, and the species appear to be rare. They are, however, inconspicuous insects and many are probably passed over. Usually fly from August to November.

43. *Chilades laius*, Cramer. (728 Bing.; 672 deN.). I have taken an odd specimen or two—in October—but the species appears to be distinctly and unexpectedly rare.

44. *Chilades trochilus*, Freyer. (729 Bing.; 673 deN.). Only once taken, in November. It is, however, such a minute and inconspicuous insect that it is easily overlooked as it flies about grass; and is probably far more common than a single capture would lead one to think.

45. *Tarucus theophrastus*, Fabr. (762 Bing.; 752 deN.).

46. *Tarucus plinius*, Fabr. (764 Bing.; 758 de N.).

Both very common, the former from June to November, the latter from September to November. Fly about *Dodonea* hedges and are very partial to the flowers of the *Plumbago capensis*.

47. *Polyommatus beticus*, Linn. (772 Bing.; 767 deN.). Appears about the end of October and is common throughout the cold weather.

In addition to the above, *Azanus jesous*, Guerin, (727 Bing.; 709 deN.), *Catochrysops strabo*, Fabr. (759 Bing.; 748 de N.) and *Catochrysops cnejus*, Fabr. (761 Bing.; 745 deN.) have been recorded from the 'Punjab plains'. They will probably be found to occur within our limits. *Catochrysops pandava*, Horsfield, (760 Bing.; 750 deN.), may also turn up, though my experience has been that it is always very rare away from the hills and submontane tracts.

Of the other sub-families, the only species I would expect to occur are *Aphnæus vulcanus*, Fabr. (908 deN.), *Aphnæus ictis*, Hewitson, (914 deN.) or one of its varieties and, possibly, *Rapala melampus*, Cramer, (1006 deN.).

HESPERIDÆ.

The Punjab plains do not suit the 'Skippers.' Only some half a dozen species have been recorded, and individuals of all but two or three of these are rare.

Sub-family—*Hesperinæ*.

48. *Hesperia galba*, Fabr. I have seen and taken only one, in October, but it is probably far more plentiful than a single capture would seem to indicate.

Sub-family—*Pamphilinæ*.

49. *Suastus gremius*, Fabr. Not common, but a few specimens may usually be taken just after the close of the rains.

50. *Padraona dara*, Kollar. Like the last, not very common, but some may always be had between September and early November. I have almost invariably taken it on the flowers of the *Duranta*.

51. *Chapra mathias*, Fabr. Fairly common from the end of the rains till the early part of the cold weather.

52. *Parnara bevani*, Moore. A damaged specimen was taken in November, but I have seen no others though I have kept a look out for them.

53. *Gegenes nostradamus*, Fabr. Was recorded by Longstaffe as "common in the gardens at Lahore" in October-November. I have, however, not seen it.

Sub-family—*Ismeninae*.

54. *Parata chromus*, Cramer. Irregular, but when appearing, is common for a few weeks in August, September and October. A small leguminous tree, which is found in many Lahore gardens, is a special attraction; one in my garden has always four or five of these insects around it.

Records of distribution would indicate the addition of *Sarangesa dasahara*, Moore, *Udaspes folus*, Cramer, and *Parnara guttatus*, Bremer and Grey, to the above list. Personally, I have considerable doubt whether these species will be found to extend so far into the plains of the north-west.

REVIEW.

A BIRD CALENDAR FOR NORTHERN INDIA

BY

DOUGLAS DEWAR.

(Thacker Spink & Co., 1916, price 6 Shillings).

Mr. Douglas Dewar is well known as a popular writer on Indian Birds and he has already a number of volumes to his credit; his readers will be glad to welcome this addition to his writings, which is decidedly an improvement on anything that he has hitherto published. Mr. Dewar caters for that portion of the European residents in India who have sufficient interest in birds to learn a little of the nomenclature, habits, and life histories of the more showy and distinctive forms around them, but at the same time are not willing to take their studies very seriously.

As is to be expected from the title the classification of this book is one of the calendar; the book is divided into chapters for the different months and each chapter deals with the chief features of bird life for that month, prefaced with a slight introduction regarding the climate to be expected. These chapters give a very good idea of the salient features of the year's bird life for the United Provinces, but an attempt has been made to attract a larger public by tacking on—often in a somewhat slipshod manner—a number of notes regarding the Punjab. This is a pity: these notes have appeared in another form in our Journal; they destroy the cohesion of the whole, and they fail to make for the Punjabi a convincing picture of the bird life of his own province, except in so far that the extreme southern districts (with perhaps some of the submountain tracts) resemble those of the United Provinces. But this is a common fault in all books that deal with India; the tendency is always to slur over rather than emphasise the divisions of the country, whereas a full appreciation of the divisions and the problems which they suggest add greatly to the zest of Indian studies.

The real value of this book lies in its suggestiveness; as he passes from month to month the reader cannot fail to notice the picture of great and unceasing changes which pass before the mind's eye—changes which are summed up in the word "migration". There are few people in England who do not recognise in some degree the comings and goings of bird life according to the seasons, but it is far otherwise in India. Apart from the Sportsman's interest in the movements of Game and Waterfowl, no heed is paid to the migrations of the birds, although it is on a far vaster scale and more noticeable than in England. A perusal of Mr. Dewar's book should change all this; but while his pages describe clearly the migrations of all best known species, it is to be regretted that he omits to make mention of some of the most interesting forms. To take but a single instance: Blyth's Reed Warbler *Acrocephalus dumetorum* passes through the Punjab in such numbers on the spring and autumn passage that its arrival and departure are most marked and form one of the clearest episodes to the observer interested in migration. Yet no attention is called to it under the appropriate months. This is no accidental omission or error in observation. Mr. Dewar is a most skilled and patient observer as every page of his book bears witness. Yet everywhere he tends to avoid the more obscure points and describe again and again facts and habits which have been well-known to generations of Anglo-Indians. The reason for this is perhaps not far to seek. Mr. Dewar prefers to catch the popular eye in preference to working for the advancement of Ornithology. There are many who regret

his choice, for his style is not sufficiently good to make his works attractive for their own sake, while his abilities would make him a most welcome recruit to the ranks of scientific workers, now alas sadly depleted by the war.

To quote Mr. Dewars own word, on page 161 he says: "Very few observations of the comings and goings of the various raptorial birds have been recorded; in the present state of our knowledge it is not possible to compile an accurate table showing the usual order in which the various species appear. This is a subject to which those persons who dwell permanently in one place might with advantage direct their attention."

This remark may with propriety be extended to refer to almost every species, save those which are *known* definitely to be entirely resident. Very little is on record regarding species which are known to be migratory while (as our author says again on p. 72) "the great majority of species, probably move about in a methodical manner in the course of a year; a great deal of local migration is overlooked, because the birds that move away from a locality are replaced by others of their kind that come from other places."

It is not necessary, however, to add the proviso "who dwell permanently in one place." All observations, however fragmentary, are of value in the present state of our knowledge, provided that they are published and left on record in print for future workers. If all who read this book are encouraged thereby to make a few observations on their own account it will not have been written in vain; let all such make a practice of writing short notes to our Journal after the manner of the numerous class of correspondents who contribute to the "notes and queries" portion of the Naturalist columns of the "Field" newspaper.

In conclusion it may be noted that the volume under review is neatly bound and printed and is remarkably free from errors both of printing and fact. Still in a future edition Mr. Dewar may care to correct his statement that no Owls and Vultures are migratory and to modify some of his theories.

ROLL OF HONOUR.

W. J. NORWOOD RYAN.

I regret exceedingly to inform you that our member Mr. W. J. Norwood Ryan was killed in action in Egypt on September 5th. At the outbreak of the War Mr. Ryan was in a business house in London, but immediately joined an Officer's training corps and finally obtained a Commission in the Dorsetshire Yeomanry; his exceedingly poor eyesight prevented his getting into the Infantry, and would indeed have been a sufficient excuse for the avoidance of Military duties. After a period of training he went to Galipoli and first saw fighting at Sulva Bay; then after short periods at Imbros and Lemnos he rejoined his regiment at Cairo in time to take part in the fight at Agagieh. Some three months later he joined the Camel Corps and was moved to the Senusi front where he was eventually reported "missing" on patrol duty; it is now known that he was killed. Mr. Ryan was a keen Ornithologist and devoted all his holidays to that pursuit. He was a close personal friend of mine and we did a great deal of collecting together. In his letters from the front he never omitted to mention the bird life that he came across.

H. W.

11th October 1915.

MISCELLANEOUS NOTES.

No. I.—MEASUREMENTS OF MARKHOR AND URIAL HEADS.

In case you keep records of heads I think these two which I was lucky enough to get recently may be worth recording:—

		<i>Ground.</i>	<i>Length.</i>	<i>Base.</i>	<i>Tip to Tip.</i>
19-4-1916.	Markhor.	Kajnag.	57"	11½"	37"
29-12-1916.	Urial.	Kalla Chitta.	34"	10"	18½"

These are both as good heads as have been shot for some years.

HASSAN ABDAL, N.W.F.P.,

A. L. MOLESWORTH, CAPT.

14th January 1917.

No. II.—JACKALS IN LOWER BURMA.

It is a common belief that there are no jackals in Lower Burma, or at all events in the lower Districts of Lower Burma, so I send you the skin of one that I shot this morning, the 24th November 1916, in the North Myanaung Reserve of the Henzada Forest Division, Kyangin Sub-Division. I shot this animal when walking along an inspection path in the Reserve. He was evidently hunting game for he came running along towards me all the time looking into the jungle to his left.

Twenty-nine years ago when I first came to the Henzada District, there were no jackals and very few hares in the District. Now both are fairly plentiful. About four years ago I caught a jackal cub in the eastern part of the Kyangin Reserve, and again three years ago I got two cubs in the Yenandaung Reserve, which is only forty miles north of Henzada town. I have on several occasions seen jackals in the Kyangin, North Myanaung and Yenandaung Reserves, and have come across their burrows. The jackals in this District seem to have acquired the hunting habits of the wild dog, for I have seen a pack of seven hunting deer not far from where I shot the one this morning, and I have seen kills of barking deer and sambar near Tatkon where I shot the animal this morning, that were undoubtedly those of jackals.

These jackals have either come across the Arakan Yomas, or else they have worked their way down from the Thayetmyo District, possibly the latter.

While on the subject of jackals I may here mention that the three cubs I got, we kept for quite a long time and they got quite tame and used to run loose in the house and were great friends with my dogs. The one I got first, got a nasty sore on his back. He evidently went into the kitchen and the cook threw boiling water on him. The skin came off and a nasty sore formed which attracted flies, and to avoid which the poor beast had to hide about in dark places. One morning he went into the Doctor's compound and hid in the godown under a box. Some servant found the poor beast and told the lady of the house that some terrible animal had got into the godown, so they were ordered to kill it, and so proceeded to go with long poles with which they jabbed at the poor beast. Eventually some one came and told my wife that our jackal had got into the Doctor's godown and that the servants were trying to kill it, so my wife sent men and rescued the poor beast and brought it back to my house. My wife noticed that the jackal could not eat meat, and one day thought that a bone had stuck in its mouth and so opened it to try and get it out. To her horror she found that what she took for a bone from the feed was nothing more nor less than the poor beast's jaw bone which had got stuck in

place and was sticking in the mouth, the jaw having been broken by the Doctor's brave body guard. My wife set the bone back and kept the jackal tied up for several days and fed it on rice boiled in soup. In about a fortnight the jaw bone set and the animal was eating bones as usual, it having made a wonderful recovery. Being kept tied up in a dark room away from flies, the back also healed and the animal was as lively as ever. One day some months after, he was found lying dead in the hedge in the garden and we supposed that a snake must have bitten him.

The second two cubs I got, went mad and died. I think they were bitten by a mad dog that came into the compound. One of the cubs bit a valuable Airedale dog I had, and he also died of hydrophobia.

As regards the hares in the District. They have spread right down to the Lemyethna Reserve which is right down in the southern end of the District. I have found them right on the summit of the Arakan Yoma hills at an elevation of 4,300 feet.

The Burmese villagers kill numbers of hares at nights with the help of "Oksoungs" lights carried in a conical shaped basket. One man carries the light on his head and throws the light from side to side, at the same time jingling tiny bells that he has tied to sticks, one of which he carries in each hand. This is to drown the sound of the footsteps. Another man carries a spear or a dah with which he kills the hare. I have seen four and five brought in killed at night. The Burmans also kill deer and pig with the help of these "Oksoungs." In the Delta they also spear alligators in the same way, but here they go in a boat, the light being kept at the prow, and no bells are used. A man stands behind the light with a spear in his hand, whilst another man paddles the boat.

C. W. ALLAN,

Burma Forest Service.

HENZADA,

24th November 1916.

NO. III.—KATHIAWAR BLACK BUCK.

When the minor Nawab Sahab of Junagadh was recently camping with Mr. Sladen and ourselves at Una in the south of the State, he secured a fine black buck with horns measuring exactly 25 inches, and giving a spread measurement of 20 inches. I have heard of even better heads being available on this side; but during the past eleven years in Kathiawar I have personally seen nothing shot with a better length of horn than 24 inches. I think the above head is worth recording as a Kathiawar trophy, though no doubt better records have often been secured elsewhere in India. I may mention that Mr. Sladen and I both together personally measured the length of horns very carefully from root to tip with a tight tape; and if we had followed the curves of the horns with the tape, the length would have exceeded 25 inches.

It may be worth recording that when we were recently moving camp in the Gir, a forest orderly riding in front of ourselves at 8 a. m. spotted a panther absolutely on the margin of the road in the grass. We had ridden by this spot with our dogs the morning before and luckily we had not them with us on this occasion. The panther when he saw the orderly close to him, quietly decamped ending with a bound into the scrub jungle; but we were surprised at his bold and confident demeanour.

H. D. RENDALL, I.C.S.

Administrator, Junagadh State.

CAMP GIR,

6th December 1916.

No. IV.—AN ARBOREAL PANTHER.

In the Miscellaneous Notes of Volumes XVII of the Journal there was some correspondence about panthers putting their kills up trees. Though two members described the habit as "common" or "not uncommon," in the specific instances quoted the animals appear to have been deposited at no great height from the ground and the following account may provide some points of fresh interest. Last hot weather when camping at K. in this district I had goats out for 3 nights before one was killed. This was dragged some 50 yards and left practically intact hanging over the fork of a large pipul tree. The goat had been tied to a log, the exact dimensions of which I forget but it must have been 6 or 7 feet long and weighed perhaps 40 lbs. This had stuck in the fork 11 or 12 feet from the ground and the goat hung suspended on the other side. I sat up in a well concealed machan till dark, but though the place was quiet and it was unlikely the panther had been lying up within hearing, it did not return. Next morning I had to move camp.

At X'mas I was again at K. and had goats out in the same bit of jungle as well as in an isolated bit of rather light jungle a mile away and on the far side of the village, open fields and a broad tank. Here a panther made his X'mas dinner off one of them. It had been tied to a small bush and the panther must have tugged persistently to remove it, for neither rope nor bush had given away and the knob had finally slipped over the top, baring it of leaves and twigs. Thirty yards away lay a lot of the goat's hair but the goat itself was nowhere to be found. Finally we came to the conclusion that the panther must have finished it "with the bones and the beak" in honour of the day, and, it was decided to sit over a fresh live goat. We looked up to select a tree and there high above us was the goat! It was in the fork of a 'mutti' tree 23 feet from the ground by measurement. The tree was quite a slender one, 2 feet 9 inches in circumference at the foot and with only two branches below that over which the goat hung and one of these close below it.

Though but little of the goat was eaten and as before there was little likelihood of the panther having heard the machan being built, yet it failed to return before dark and I had not the hardihood to wait below in the hopes of an overhead shot against the stars.

Next morning the remains of the goat were found in a banyan tree about 100 yards away. Only the head and part of the skin were left and these deposited 12 or 14 feet from the ground. I sat up again that evening but with no better luck than before.

It is interesting to speculate what induced this habit—presuming the same panther to have been concerned in each case. A natural suggestion was that it was done to secure its meal from red dogs which are plentiful in the jungle in which the first kill occurred, but its actions must have been guided by instinct rather than reason, for in that case though the branch over which the goat hung was not less than 11 feet up, the goat itself suspended at the end of the rope stretched down to within easy reach of any dog.

Possibly a further acquaintance with the same animal will throw more light on the question. The habit of only returning late to its kill may also be one of its characteristics.

DHARWAR, 8th January 1917.

J. R. JACOB, I.P.

No. V.—NOTE ON THE SCALY ANTEATER (*MANIS CRASSICAUDA*).

About 3 p.m. on the 11th February 1914, in the North Tongoo Division, noticed close to my tent what I thought was a snake coiled round the

top of a small tree about 12 feet from the ground. It was a large pangolin and was so tightly coiled round the tree that a man who climbed the tree could not dislodge it and it was only freed from the tree after the tree had been cut down. When it rolled itself into a ball it placed the toes of its hind feet under the scales of its chest and it was very difficult to straighten it out. It was infested with ticks of the kind one commonly finds on snakes (*Apomma* ?). I enclose a photograph* which shows the strength of the prehensile tail, the whole weight of the body being supported on the branch from which it hangs by the extreme tip of the tail (the pangolin and the binturong *Felis binturong* both found in Burma are the only mammals of the old world with a prehensile tail.) In the evening I let it go in the jungle to the great disgust of the Burmans who said they could get Rs. 15 for it from any Chinaman. Chinamen use parts of these animals as an aphrodisiac. Burmans have a widespread superstition about this animal that it cries out and calls people by name. If the person called replies he dies at once. I was told by a fairly well educated Burman that a Forest Ranger who died suddenly at Pinyinana Forest School sometime ago died because he replied to a scaly pangolin. This superstition is a nuisance as Burmans are very reluctant to reply to shouts in the jungle. I have often noticed this when girdling teak or when belated dak runners are approaching camp after dark. It would be interesting to know whether this animal does cry out and whether its cry at all resembles the human voice?

S. F. HOPWOOD, I.F.S., R.F.A.

FRANCE,

31st August 1916.

NO. VI.—LARGE PINTAILED SANDGROUSE (*P. A. CAUDATA*)
SETTLING ON WATER.

I have occasionally wondered whether my eyes were deceiving me when I thought I saw Sandgrouse settling on the water to drink. But I have now been able to verify this habit, in one species at any rate. A day or two ago a pair of *Pteroclorus alchata caudata* settled in front of me, on the R. Tigris, and about 60 yards from the bank. After slaking their thirst in a leisurely manner, they got up, and flew away. When on the water they floated high, and looked like gulls. I do not know whether this habit has been recorded before in the case of Sandgrouse, or not, but mention it for what it is worth.

H. A. F. MAGRATH, Lt.-Col.

MESOPOTAMIA,

12th November 1916.

NO. VII.—OCCURRENCE OF THE WOOD-SNIPE (*GALLINAGO*
NEMORICOLA) IN SAISSETTE.

On January 18th I shot a Wood-snipe in the jungle, a few miles from Thana. The locality agreed with that described by Stuart Baker as being the one most favoured by this species (*vide* article on the Wood-snipe beginning on page 270 of Vol. XX of the Journal), that is to say the bird was flushed out of thick high grass bordering a long series of small rice fields in a narrow valley in the midst of thick jungle at a height of perhaps 100 feet above sea level. The time of day was 11 A.M. The snipe got up without any cry and flew straight for a narrow gap in the high grass where he meant to adopt Wood-cock tactics. He flew slowly and floppily and looked strangely big and most strangely dark. I had to take him before

* Unfortunately the photograph is too indistinct for reproduction.—Eds.

he dodged behind cover and consequently he was rather broken up. The bird was in good condition and was made over the same evening to the Society and his measurements recorded. Having shot a couple of this species in Kulu I was pretty sure of its identity but not knowing it to be so unusual did not question the shikari as to the frequency of its occurrence. He appeared to know of it quite well, but his knowledge may have been assumed. Only one specimen is recorded as having been shot near Bombay before, that of Mr. T. H. Moore in January 1896. Possibly the species occurs not uncommonly, but is not identified.

The Wood-snipe weighed $5\frac{1}{2}$ oz.

M. L. FERRAR, MAJOR.

BOMBAY, 31st January 1917.

NO. VIII.—NOTE ON THE HABITS OF THE CHECKERED WATER SNAKE (*TROPIDONOTUS PISCATOR*.)

A few days ago I saw an interesting display of fishing by a snake. The basin in front of the sluices of Walwhar lake was being emptied through the 15th valve provided for that purpose and numbers of small fish were being shot through and as they came out of the pipe were trying to jump clear of the stream of water. The snake was sitting on top of the pipe and darted its head at the fish in the air. I saw it catch one fish about 4" long but it only managed to hold it for a few seconds before it broke away. I killed and preserved the snake and am sending it down to you and should be much obliged if you would kindly identify it.

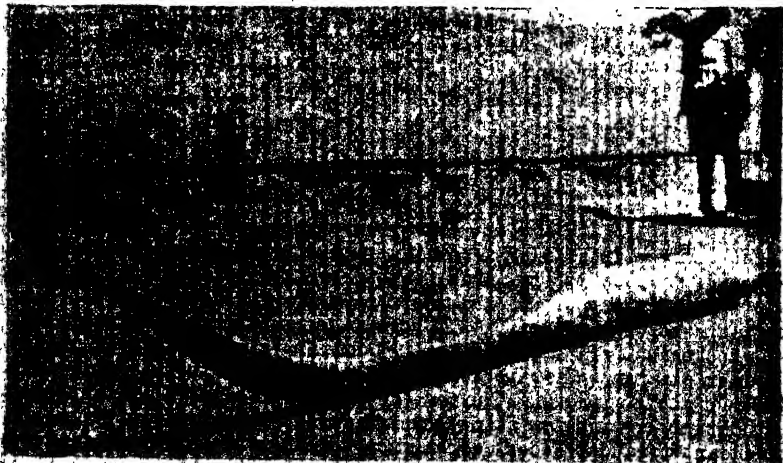
B. D. RICHARDS.

LONAVLA,

2nd December 1916.

NO. IX.—FEEDING HABITS OF THE PYTHON (*PYTHON MOLURUS*.)

I enclose a photo of a 13½ feet Python which I killed sometime ago in the Northern Shan States about 15 miles from Lashio. The reptile had



only lately swallowed a 3 year old barking deer (male) which, when the snake was opened up, was found quite fresh inside, some of the hair being still dry. The only bone broken was the near hind leg; the fore legs and ribs were intact. The horns were gone too; at least I take it there had been horns for the roots were raw and bloody. I may add that a couple of Burmans asked for permission to take the deer away to eat! Permission was granted. My cook a Burman, rather amused me by stating quite gravely that the snake, after digesting its meal, would hang itself by the tail over the branch of a tree and shake its head until the indigestible bones came up. It would be interesting to know if a like superstition exists in Assam or in other places where this variety of snake is found.

I may add that the measurement was taken by tape as the reptile lay on the ground and was found to be just over the 13½ feet.

C. G. STEWART.

MINBU, BURMA,

7th October 1916.

No. X.—OCCURRENCE OF RUSSELL'S EARTH SNAKE (*ERYX CONICUS*) AT 2,200 FEET ALTITUDE IN THE C. P.

Herewith the Railway receipt for the Earth Snake *Eryx conicus* despatched to-day. As he was caught on the 2nd instant and has not fed since, he should be redeemed quickly.

I was waiting for the beat to come up, in scrub jungle, when a grasshopper flying away with signs of agitation attracted my notice to the snake. The aborigines, after inspection, pronounced it to be highly venomous! "He blows on men and cattle and they swell as large as elephants. He kills his prey like the python." This was half true.

On consulting the map of its distribution in your Journals I notice that its occurrence in the C. P., at a height of about 2,200 ft., is remarkable.

C. G. CHEVENIX TRENCH, I.C.S.

BETUL, C. P.,

7th December 1916.

No. XI.—NOTE ON THE HAMADRAYAD OR KING COBRA (*NAIA BUNGARUS*) IN NORTH KANARA.

The Hamadrayad is nowhere very common, and many years ago, when engaged on survey work in North Kanara, I never even heard of one although I had the best of opportunities for doing so. The first one that I ever saw in the district, was at Supa, in 1914 when revisiting my old haunts. It was found coiled up in the fork of a tree near the Kali Nadi, by wood cutters, who informed some snake charmers living at Supa, of their find and the latter went out at once and snared it. It was a fine adult specimen about 11 feet long and of a pale olive-green colour, but did not look very happy when I saw it, owing to the bad treatment it had received at the hands of the snake charmers, who had extracted its fangs.

This year (1916) when encamped at Potoli in the same district, I was fortunate enough to be able to renew my acquaintance with the snake. I had for sometime been offering a reward to any one who would show me one, but although the natives were apparently well acquainted with the snake and had a wholesome dread of it, they said that it was very rare.

However, one day, one of the local *Gowdas*, or village headmen, came and announced that he had learnt, of the whereabouts of a *Nagin*—the local name for the Hamdrayad—from a man who, when coming along a short cut, as a guest to some marriage festivities at the Gowda's house, saw it lying on the top of a heap of dead leaves by the side of the path.

The *Gowda* added, that he would find out from this man, the exact spot where the snake had been seen and take me to it, as soon his marriage festivities were over, promising me that we should find it still there. The path, he added, had in the meantime been closed, as no one dared to use it.

Some days later, the *Gowda* returned to say that he had just come from seeing the snake which was lying on the heap of leaves just as when it had first been seen. It did not take us more than a few minutes to reach the spot. The mound of leaves, which was about 2 feet high with a circumference of about 8 or 9 feet, stood in the *rai* or evergreen jungle at the bottom of a decline in a small dry *nala*, about 30 yards below the road leading up the Potoli Ghat, and within a few feet of the footpath already mentioned.

I had no means of catching the snake alive, so had taken my gun with me. The light in the *rai* was none of the best, at the time, but after a little manoeuvring, I managed to catch light of what appeared to be the snake's head, and fired. There was much struggling amongst the leaves when I did so, but a second shot into the heap put a stop to this.

On hauling the snake out of the leaves I was disappointed to find that it was a comparatively small one being only 9'-3" in length, and judging from its colour which was jet black with irregular yellow bands about $\frac{1}{2}$ inch wide, at 3" intervals all down its body and tail, it was apparently a young one. The throat was yellow and it had all the necessary scales, to prove it was a Hamdrayad.

On seeing it at close quarters, the *Gowda*, and in fact all the natives said that this was the *Kali* or *Derañ Nagin*, and known as such by its dark colouring. The other, light coloured one, they called the *Nagin*, not being aware that in reality, they were one and the same snake, at different stages of its growth; although according to Wall, the adults vary a good deal in colour and are sometimes coloured like the one I shot.

I have never seen noticed anywhere the habit these snakes appear to have of lying up in heaps of dead leaves which are undoubtedly collected together for the purpose. The *Gowda* who seemed to be well acquainted with the habits of the snake said that they invariably make their home in such a heap.

I examined the heap of leaves carefully but found nothing in it, nor did I succeed in finding another snake.

On dissection I found the stomach quite empty. Its body was covered with a large number of ties, holding on below the scales.

L. L. FENTON, Lt.-Col.

MARSH HALL, SOUTH MOLTON, N. DEVON,

22nd October 1916.

XII.—FOOD OF THE BULL FROG (*RANA TIGRINA*.)

I am sending you two frogs and I hope they reach you alive. I was in my room dressing for dinner when I heard a noise similar to that made by a frog when caught by a snake. I called my servant and told him to take a lamp and kill the snake. He and two other Kalasis went to do this—the boy then returned and told me that it was not a snake but another frog biting a frog and eating it. I went out and there I saw the

green frog that has the thin white streak from nose to rump firmly attached to the back of the ordinary frog and when touched would not leave or let loose his grip. The green frog had the skin of the other frog in its mouth and when teased he jumped quite $2\frac{1}{2}$ feet with the other frog in its mouth.

N. DAVIDSON.

RAICHUR,
19th October 1916.

[The 'two frogs' when received were found to be a medium sized Bull Frog (*Rana tigrina*) and a young common Toad (*Bufo melanostictus*) which was evidently being eaten by the former.—EDS.]

No. XIII.—THE GREAT INDIAN SPIDERS, (GENUS
PECILOThERIA).

In a very interesting account of the Great Indian Spiders, by R. I. Pocock of the British Museum of Natural History, which appeared in the Annals and Magazine of Natural History, Series 7, Vol. II in January 1899, and was reprinted in Vol. XIII, No. I of our Journal, it was stated that eight different species of the spider were then known to the Museum, which also possessed specimens of one or both sexes of each species.

These were:—

- No. 1, *P. fasciata*, from Ceylon.
- " 2, *P. subfusca*, " Ceylon.
- " 3, *P. vittata*, " India.
- " 4, *P. regalis*, " "
- " 5, *P. formosa* " "
- " 6, *P. metallica* " "
- " 7, *P. striata* " "
- " 8, *P. ornata*, " Ceylon.

The males of 1, 2 and 4 only were known, so there was much room for further research, but I am not aware that any further discoveries have since been made.

These spiders are not, I believe, as rare as is generally supposed, but living as they do, in burrows and trees, they escape observation.

Last April, one was brought to me at Khandala, it having been found in a hole half way up a post in the stables at the Convalescent Home. Not a single person there, either European or Native, to whom I showed it, had ever seen one before. I have since had no difficulty in identifying it as *P. regalis*; Pocock mentions having identified this species from Matheran, so it may be the commonest, if not the only species found in this part of India. I tried my best to get another specimen but with no success.

In May last, I was more successful, when encamped at Potoli, Supa Taluka, North Kanara, where I captured two females, but they belonged to quite a different species which I have not as yet been able to identify. Their description tallies more nearly with that of *P. metallica*, than with any of the others on Pocock's list, being of a uniform chocolate colour all over the body and legs, but wanting the single orange spots on the *tibia*, which is the distinguishing mark of *P. metallica*. At the first opportunity I intend to have them identified at the Natural History Museum, when I will communicate the result.

The measurements of the largest of the two are as follows, in millimetres:—

Total length of body	55
Length of carapace	26
Width of carapace	20

Length of palp	47
" " 1st leg	74
" " 2nd leg	66
" " 3rd leg	55
" " 4th leg	70
Patella and Tibia of 1st leg	28
" " " 2nd leg	25
" " " 3rd leg	20
" " " 4th leg	25
Protarsus of 4th leg	16

Quite by accident, I came across a silk lined burrow, in the jungles, which I suspected belonged to one of these spiders. On introducing a stick into it, I however failed to move or feel anything, so placing a dead leaf over the mouth of the burrow, I left it until the following morning, when on my return I found that the leaf had been moved aside during the night and fastened with a few threads to one side of the mouth of the burrow—clear proof that the latter was occupied. The burrow was made on a clean open space of slightly sloping ground, away from any trees or shrubs. The ground was very hard, and it was not until I had dug to the very bottom of the burrow—2 feet in an almost perpendicular direction,—that I found the spider, and about 30 or 40 young ones crawling over and around her. The mother showed very little fight. The young ones measured about 1/3rd inch across. The diameter of the section of the burrow measured as nearly as possible 2 inches. The burrow was beautifully lined with silk throughout.

On looking about, I found another burrow, within a few yards of the first one. It was a *facsimile* of the latter and like it contained a female with a large number of young ones of a similar size as the first lot.

Unlike the natives I enquired of at Khandala, those in Kanara were perfectly well acquainted with these spiders which they knew by the name of "Waghri's."

They stated that their bite would draw blood and that they were poisonous but the poison was not of a very virulent nature? Pocock mentions that they possess poison-glands of large size, and are armed with irritating bristles.

L. L. FENTON, Lt.-Col.

MARSH HALL, SOUTH MOLTON, N. DEVON.
22nd October 1916.

NO. XIV.—THE "PREYING MANTIS" AS AN ENTOMOLOGIST.

My knowledge of the *Mantida* is very limited, but I had always understood that they preyed on comparatively small insects, such as most of us have seen them skittering on our dinner tables. I was mistaken, but I must say I was considerably surprised to find one tackling one of the *ornithoptera* group of butterflies.

Last May, I was encamped at Potoli in the Supa Ta'uka, North Kanara, and one morning, when hunting butterflies in the local evergreen jungle, noticed a *Papilio* ~~miss~~ in effectually struggling to get away from a large bunch of flowers, on a tree, about 12 feet above the ground. I at once thought it must have got entangled in a spider's web, but there was no time to waste, and hastily scrambling up the tree, with the assistance of a native, I succeeded in clapping my net over the flower before the butterfly had escaped, and broke the former off at the stem. On regaining the ground and carefully examining my capture, I found no trace of a spider's

web nor was there anything of a sticky nature on the flowers, whereas, besides the latter and the butterfly, the net contained nothing else but a large "Preying Mantis" about 4 inches long and I am quite convinced that it alone was responsible for the capture.

I only regret I omitted to preserve the Mantis in order to ascertain its species.

L. L. FENTON, Lt.-Col.

MARSH HALL, SOUTH MOLTON, N. DEVON,
22nd October 1916.

No. XV.—SOME CERAMBYCIDS FROM KURSEONG.

A miscellaneous collection of insects made by me in the Government Forest at Kurseong (altitude 6,000' and over) include the following Cerambycids. The numbers against each species refers to the same in the *Fauna of British India* Series, Coleoptera Vol. 1, *Cerambycidae* by Gahan:—

Sub-family, PRIONINÆ.

- 5. *Lophosternus indicus*, Hope.
- 41. *Egosoma tibiale*, White.

Sub-family, DISTENIINÆ.

- 54. *Cyrtoneps punctipennis*, White.
- 57. *Distenia kalidasæ*, Lameere.

Sub-family, CERAMBYCINÆ.

- 131. *Hoplocerambyx spinicornis*, Newman.
- 133. *Pachydissus parvicollis*, Gahan.
- 194. *Rosalia hariola*, Thoms.
- 197. *Rosalia formosa*, Saund.
- 205. *Zonopterus flavitarsis*, Hope.
- 220. *Chloridotum nympha*, White.
- 268. *Xylotrechus subdepressur*, Chev.
- 374. *Aglaphis fasciata*, Thoms.

E. A. D'ABREU, F.R.S.

CENTRAL MUSEUM, NAGPUR,
3rd October 1916.

No. XVI.—NOTE ON A FLIGHT OF SPHINGIDÆ.

On the 18th October at about 5 a.m., some 60 miles off the North-Western Konkan Coast, (Lat. 19. 45 N. Long. 71. 40 E.) I was fortunate enough to observe a remarkable flight of *Lepidoptera*.

The vast bulk of these belonged to the *Sphingidæ* of which I took the following species:—

<i>Acherontia lachesis</i>	..	Only one specimen.
<i>Protoparce convolvuli</i>	..	Six specimens.
<i>Nephele hespera</i>	..	Eleven specimens.
<i>Choerocampa theylia</i>	..	Many hundreds.
<i>Choerocampa celerio</i>	..	About one hundred seen.

Amongst the above at least one or two species of *Choerocampa* which have not as yet identified.

In addition there were many *Noctuidæ*, *Geometridæ*, *Bombycidæ*, and a sprinkling of butterflies amongst which latter I observed *Terias* and a few *Heperidæ*. Two species of *Odonata* and one *Phanidæ* were also observed. The insects had apparently been carried seaward in

the recent cyclone as we were in its neighbourhood at the time. The moths came at dawn and for some hours afterward they could be seen clinging to every kind of object, coils of rope and cane chairs being the favoured resting spots, these harmonising with their colouration and affording some protective concealment. The *Convolvuli* in particular chose coils of seasoned rope and weatherworn wood on which it was quite difficult to spot them.

I saw more *Sphingides* in one hour than I had seen in a decade in India.

F. C. FRASER, CAPT., I.M.S.,
Hôpital Ship "MADRAS."

BOMBAY, 20th Sept. 1916.

NO. XVII.—NOTES ON THE LARVA OF *DILEPHILA LIVORNICA* (STRIPED HAWK MOTH).

I found large numbers of larvæ feeding on a milky plant with a yellow flower at Changla Gali, Murree Hills, in June.

The plant was growing in a single sunny nullah and spur, and there must have been many hundreds of larvæ in this small area.

When first hatched the larva is a dirty white colour, with the head and horn black. When about half an inch long a number of white dots appear. These dots gradually form into a series of eleven white spots on each side, the head and horn being black, and the rest of the body black, dotted with white.

When the larva is about one and a half inches long, all the white markings turn yellow, only the spiracles being white. As the larva grows the yellow spots become more conspicuous.

When full grown it is over three inches long, and has a very striking appearance.

After reaching full growth the larva becomes very restless, leaves the good plant and searches for a suitable place in which to pupate. It digs a few inches into the ground, spins a slight cocoon and turns to a pupa in about a week. The pupa is a bright reddish brown colour, with darker markings, the head and thorax being green with brown dots.

Moths emerged in March 1916 from pupæ obtained in June 1915.

In spite of its conspicuous colouring, the caterpillar feeds during the day, often a large number of all sizes on one plant, with no attempt at concealment. When the plant is approached, all the caterpillars jerk back the head and upper part of the body, and eject from the mouth large drops of a clear green fluid. The drops fall in a small shower round the plant. From these habits it would appear that the caterpillar is distasteful to insectivorous birds, etc. I noticed some caterpillars which I kept, sucking up greedily the milky juice which exuded when the food plant was broken.

Scott in describing the larva of the Striped Hawk Moth (*Dilephila livornica*) in his "Moths of the British Isles" does not mention this habit, so like that of some grasshoppers, of ejecting fluid from the mouth.

I do not know of any other Hawk Moth larva which has this habit.

F. B. SCOTT, CAPT., I.A.,
Atthd. 69th Punjabis.

PROCEEDINGS

OF THE MEETING HELD ON THE 17TH JANUARY 1917.

An "At Home" of Members and their friends of the Bombay Natural History Society took place on Wednesday, the 17th January.

The election of the following 34 new members since the last meeting was announced:—The Principal, Mayo College, Ajmer; H. R. H. Prince Abhakara of Chumponu, Bangkok, Siam; 2nd-Lt. G. R. Smith, I.A.R.O., Mesopotamia; Lt. W. R. F. Trevelyan, Mesopotamia; the Mess President, 2-8th Gurkha Rifles, Landsdowne; Lt.-Col. R. A. Firth, Landsdowne; Lt. T. R. Livesay, I.A.R.O., Mesopotamia; Mr. O. Haeffiger, Lyallpore; Mr. A. N. Grieve, Purulia; Mr. Duncan Macgregor, Lahore; Capt. C. H. B. Borth, R.A.M.C., Basra; Mr. C. E. Lynch-Blosse, Junagadh; Mr. A. MacDonald, Champaran; Rev. A. F. R. Bird, Nandyal R.S.; Lt. N. M. Adam, R.A., Mesopotamia; Lt. D. P. Blair, R.A.M.C., Beshire; Prof. I. W. Johory, M.A., B.D., Indore; 2nd-Lt. R. E. Cheesman, Basra; Mr. G. Wesche Dart, Bombay; Mr. S. G. de C. Ireland, I.C.S., Fatehpur; Capt. G. H. Russell, Wano; the Secretary, Central Circulating Library, S. I. Railway, Trichinopoly; Lt.-Col. C. D. Dawes, I.M.S., Bombay; Capt. J. Crompton, Bannu, N.W.F.P.; Mr. H. Parker, I.C.S., Homalin; Mr. A. C. Morrell, Travancore; Lt. Ernest E. Cunnah, R.A.M.C., Meerut, U.P.; Mr. R. H. Cassell, Moniarah; Mr. George D. Moore, Moniarah; the Mess President, 94th Russell's Infantry, Tank, N.W.F.P.; Mr. G. D. Traylen, Bombay; Mr. W. K. Dods Calcutta; Mr. W. E. Ley, I.C.S., Chanda, C.P.; Mr. A. Hampson, Bombay.

The contributions to the Society's Museum during the last four months are remarkable for the wide range of localities from which they have been received—localities extending from Mesopotamia to Siam and from Gilgit to Trichinopoly.

Beginning with Mesopotamia the Society is much indebted to Sir Percy Cox and Lt. R. E. Cheesman, I.A.R.O., for 37 bird skins, all of which are of great interest. From Major-General Sir H. Keary come several spotted sandgrouse and two starlings very similar to the European Starling. Capt. C. R. S. Pitman has sent in skins of two kinds of sandgrouse and two birds of prey, an eagle and a buzzard, and Major F. P. Connor a number of insects, snakes, lizards and birds and a scorpion alive. Lt.-Col. F. Wall, C.M.G., I.M.S., and Lt. Livesay, I.A.R.O., have presented much wanted jackal skins and the latter has also sent the head and neck of a wild goose *A. ferus*. From Major G. A. Perreau a fine wild cat also several bird skins. From Capt. C. M. Ingoldby, R.A.M.C., comes a Persian robin, while Col. Stevens and Major Dickinson took the trouble to send down alive two small desert lizards of the genus *Agama*. Lower down the Gulf, at Muscat, Major A. R. Burton has been active in increasing the Society's collections and he has sent in the skin of an Arabian fox, numerous lizards and snakes, as well as a number of birds alive, including some Arabian seesees and Close-barred Sandgrouse. On the other side of the Gulf, in Persian Baluchistan, Capt. J. E. B. Hotson, I.A.R.O., has done much on the Society's behalf and two small but interesting collections of mammals, birds, snakes and insects, as well as botanical specimens have been received from him.

Coming now to the borders of India proper, Capt. W. B. Cotton, I.A.R.O., from Wano, has presented two fox skins, a couple of Afghan nares, also a skin of a cat which appears to be a hybrid between a domestic and a desert cat *F. ornata*. Major Humphrys from Miranshah sent in a live fat-tailed lizard perfectly harmless, but often considered by natives to be a poisonous

species. From Gilgit Major A. D. Macpherson has presented a Levantine viper, a European species only occasionally found in India. A number of interesting bats from the Teesta Valley have been received from Mr. A. Primrose and Mr. F. Field. Palamau has contributed several snakes and mammals and from Dr. Malcolm Smith in Siam has come a welcome collection of snakes, lizards and frogs. A number of Imperial Sandgrouse skins have been presented by Col. H. H. the Maharaja of Bikanir and from Simla Mr. G. C. Shortridge, who was there on sick leave from Mesopotamia, sent some butterflies. Mr. T. R. Bell has generously handed over to the Society a collection of shells made at Karachi as well as a large number of butterflies, moths and other insects, comprising some 1,900 specimens all perfect specimens from Kanara. It is hoped to be able to furnish a detailed list of this collection shortly.

The Honorary Secretary acknowledged the following contributions since the last meeting :—

Contribution.	Locality.	Donor.
Three mammals : Tibet Marmot, <i>A. himalayanus</i> , Pale Weasel, <i>M. temon</i> , Large-eared Mousehare, <i>O. aurita</i> .	Garhwal ..	Mr. A. E. Osmaston, I.F.S.
1 Common Wolf, <i>C. pallipes</i> ..	Etawah, W. P. ..	U. P. Govt.
1 Andaman Palm-civet, <i>P. tyleri</i> .	Port Blair ..	Mr. F. B. Leach, I.C.S.
1 Jackal, <i>C. aureus</i> and head and neck of Grey Lag Goose, <i>A. ferus</i> .	Mesopotamia ..	Lt. I. R. Livesey, I.A.R.O.
5 Mammals : 2 Desert Foxes, <i>F. leucopus</i> , 1 hybrid ? Desert cat, <i>F. ornata</i> , 2 Afghan hares, <i>L. tibetanus</i> .	Wano ..	Capt. W. B. Cotton.
1 Jackal, <i>C. aureus</i> ..	Mesopotamia ..	Lt.-Col. F. Wall, I.M.S., C. M. G.
5 Mammals, including, Panther, <i>F. pardus</i> , Afghan Hedgehog, <i>E. macrotis</i> , Persian Lowland Hare, <i>L. crassipodex</i> , 2 mice, a bat and a fox, 33 birds, 4 fishes, 33 snakes, 2 lizards, 3 scorpions, 2 centipedes and a number of insects and botanical specimens.	Pers.-Baluchistan Frontier.	Capt. J. E. B. Hotson.
1 Fishing Cat, <i>F. viverrina</i> ..	Habb river ..	Mr. R. L. McCulloch.
1 Jackal, <i>C. indicus</i> ..	Henzada,* Burma.	Mr. C. W. Allen.
1 " " ..	Taungdwingye, Burma.	Mr. F. C. Parkis.
1 Bamboo Rat, <i>C. badius</i> ..	Chin Hills ..	Mr. A. Wright.

Contribution.	Locality.	Donor.
1 Arabian Fox, <i>V. arabica</i> , 2 snakes, <i>T. guntheri</i> , <i>Z. rhodorachis</i> , 2 lizards, 1 centipede, 6 scorpions and some insects, also 5 Close-barred Sandgrouse, <i>P. lichtensteini</i> , Arabian Seesee, <i>A. heyi</i> , Barbary Falcon, <i>F. barbarus</i> ? 4 Persian Turtle Doves, <i>S. t. arenicola</i> and 1 Blue Roch Thrush, <i>M. saxatiles</i> .	Muscat ..	Major A. R. Burton.
Four mammals, including a Persian Mongoose, <i>M. persicus</i> , and a Syrian Hedgehog, <i>E. calligoni</i> , and 3 birds, 1 Blue cheeked Bee-eater, <i>M. persicus</i> and Pin-tailed Sandgrouse, <i>P. a. caudata</i> .	Mesopotamia ..	Major F. P. Connor, I.M.S.
3 Lizards		
1 Tree Frog and a number of insects.		
Five Mammals: 1 Short-tailed Mole, <i>T. micrura</i> and four bats.	Gopaldhara ...	Mr. H. Stevens.
3 Mammals: 1 Smaller Bandicoot Rat, <i>B. nemorivaga</i> , 1 Fulvous Leafnosed Bat, <i>H. fulvus</i> and 1 pipistrelle, 1 bird.		
5 Snakes: Brown Tree Snake, <i>D. trigonata</i> , Painted Tree Snake, <i>D. pictus</i> , Green Pit Viper, <i>L. gramineus</i> , Kukri Snake <i>O. subgriseus</i> and Green Whip snake, <i>D. mycterizans</i> .	Niterhat Dist., Palaman.	Mr. F. Field.
1 Scorpion		
18 Bats	Teesta Valley ..	Mr. A. Primrose.
1 Jungle Cat, <i>F. chaus</i> ; Three birds: 1 Montagu's Harrier, <i>C. cineraceus</i> , 2 Spotted Sandgrouse, <i>P. senegallus</i> and 1 Black Partridge, <i>F. vulgaris</i>	Mesopotamia ..	Major G. A. Perreau.
1 Snake, <i>Coluber hodgsoni</i> , alive.		
1 Spotted Himalayan Scops Owl, <i>S. spilocephalus</i> .	Dharamsala ..	Mr. G. H. Donald.
5 Snakes: Royal Snake, <i>Z. diadema</i> , Iridescent Earth Snake, <i>X. unicolor</i> , Buff-striped Keel-back, <i>T. stollatus</i> , Banded Krait, <i>B. fasciatus</i> and <i>S. olivaceus</i> .	Pegu, Burma ..	Mr. J. M. D. Mackenzie.
2 Scorpions		

Contribution.	Locality.	Donor.
1 Krait, <i>B. ceruleus</i>	Deolali	Capt. Malone.
10 Snakes	Siam	Dr. Malcolm Smith.
14 Lizards		
10 Frogs	Monachera P.O. ..	Mr. W. Short.
1 Snake, <i>Dipsadomorphus heva-</i> <i>gonatus</i> (alive).		
1 Levantine Viper, <i>V. libetina</i> ..	Gilgit	Major A. D. Mac-
7 Birds : 5 Spotted Sandgrouse, } <i>P. senegallus</i> , 2 Starlings, <i>S.</i> } <i>vulgaris</i> .	Mesopotamia ..	Maj-Gen. Sir H.
11 Bird skins : Spotted Sand- } grouse, <i>P. senegallus</i> , Pint- } tailed Sandgrouse, <i>P. a.</i> } <i>caudata</i> , Long-legged Buz- } zard, <i>B. ferox</i> , Steppe Eagle, <i>A.</i> } <i>nepalensis</i> , Crested Lark, <i>G. c.</i> } <i>magna</i> , Skylark, <i>A. arvensis</i> . }	Do.	Capt. O. R. Pitman.
36 Bird skins and 3 beetles ..	Do.	Sir P. Z. Cox and Lt. Cheesman.
1 Rufous Cylinder Snake, <i>C. rufus</i>	Bhamo	Capt. A. C. Frere.
1 Spotted Sandgrouse, <i>P. sen-</i> <i>gallus</i> .	Mesopotamia ..	
1 Bittern, <i>B. stellaris</i>	Bombay Dist. ..	Mr. A. F. Forbes.
2 Lizards, <i>Agama isolepis</i> (alive) ..	Busra	Col. Stevens and Major Dickinson.
25 Imperial Sandgrouse, <i>P. are-</i> <i>narius</i> .	Bikanir	H. H. the Maharaja.
2 Coronetted Sandgrouse, <i>P.</i> <i>coronatus</i> .	Kohistan	Mr. R. L. McCalloch.
1 Water Cock, <i>G. cinerea</i>	Marmugao	Mr. W. Coen.
1 Persian Robin, <i>E. hyrcanus</i> ..	Mesopotamia ..	Capt. C. M. Ingold- by, R.A.M.C.
1 Fat-tailed Lizard, <i>E. macularia</i> and a buprestid beetle.	Tochi Valley ..	Major F. H. Hum- phrys.
A number of snakes, fish and centipedes in spirit, a large number of butterflies, moths, dragonflies, grasshoppers, mantids, cicadas, hemip- tera, diptera and spiders, a quantity of shells and four eggs of common peafowl, <i>P.</i> <i>cristatus</i> and four of com- mon sandgrouse, <i>P. cristatus</i> .	Kanara and Kara- chi.	Mr. T. R. Bell.
A few birds, fish, lizards and insects.	Katwar	Mr. N. B. Kinnear.



Gomphus alioctatus.
THE WHITE-CHINNED KALIA.

JOURNAL OF THE Bombay Natural History Society.

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VOL. XXV.

No. 2.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U.

PART XXII.

With a Coloured Plate.

PHASIANIDÆ.

Genus—*GENNÆUS*.

In 1915 I wrote a revision of this beautiful group of pheasants, which appeared in the Journal of this Society, Vol. XXIII, p. 658 (May 1915). I then gave at considerable length my reasons for retaining some of the species and sub-species which had been described by Oates and others, and for eliminating a large number which, with the greater material then available, were found to be untenable.

Since this review was published, there are only two points upon which I have been able to obtain further evidence and material to show that the deductions then drawn require alteration.

The first of these necessitates the suppression of *cuvieri*. There appears to be no doubt that this so-called sub-species has no definite geographical range, but crops up here and there where the lower habitat of *horsfieldi* meets suddenly the higher habitat of *nycthemerus rufipes*, *williamsi*, or *oatesi*. The skins which I have been able to examine show that *cuvieri* is either a hybrid between totally distinct species, or merely forms a very thin, ill-defined

line of connection between *horsfieldi* and various other sub-species. Nowhere is this line sufficiently defined or wide enough to justify *curieri* being retained as a good sub-species.

Secondly, the discoveries of Robinson, Guildenstolpe, Herbert, Kloss, and others have shewn that the range of true *lineatus* has to be very greatly extended, though still further material is required before we can say definitely what is the range of *lineatus* and what of *sharpai*. It would appear, however, that Silver Pheasants of some kind very nearly related to, if not the same as, *Gennæus lineatus lineatus*, are to be found as far South as 12°, and also East well into many portions of South and West Siam. At what particular point *lineatus* merges into *sharpai* has still to be worked out with exactness, and to do this will require a much greater mass of material than is now available.

I retain *ripponi* for the present, though with a good deal of hesitation, and if more specimens for examination are obtained from the Trans Salween and Mekong River areas this sub-species may also have to be suppressed.

The Genus *Gennæus* contains the pheasants popularly known as Kalij and Silver Pheasants, and are certainly the most closely allied of all our Indian Pheasants to the Jungle-Fowl. They are heavily built, powerful birds with comparatively short rounded wings; tails compressed, of sixteen feathers, either of great or moderate length, and with the central feathers longest; their legs are short and fairly long, and are armed in the males with powerful spurs, one on each leg, and only abnormally two.

The head is crested in both sexes, and the sides of the head are bare and highly coloured.

KEY TO SPECIES: MALES.

A. Crest white light brown .. *albocristatus*.

B. Crest black.

a. Upper plumage black, feathers with pale edges, and rump barred with white, breast largely whitish *leucomelanus*.

b. Upper plumage wholly black, breast largely whitish *melanonotus*.

c. Upper plumage black; rump boldly barred with white; breast black *horsfieldi*.

d. Upper plumage grey, formed by narrow vermiculations and bars of black and white *lineatus*.

e. Upper plumage almost white with sparse, narrow bars of black... *nycthemerus*.

KEY TO SPECIES : FEMALES.

- A. Lower plumage more or less mottled or squamated and with pale shafts but not with white or buff streaks.
- a. Rather paler below..... *albo cristatus*.
- b. Rather darker below.
- a'. Central tail feathers well mottled and distinctly *leucomelanus*.
grey about neck *melanonotus*.
- b'. Central tail feathers not much mottled and no grey on neck.
- a''. Central tail feathers dark chestnut, contrasting greatly with lateral ones.. *horsfieldi horsfieldi*.
- b''. Central tail feathers pale chestnut, contrasting greatly with lateral ones. *horsfieldi williamsi*.
- B. Lower plumage with white or buff and not squamated
- c'. Central streaks buff and confined principally to breast and flanks *lineatus outesi*.
- d'. Central streaks white, numerous everywhere, but narrow; under plumage bright rufous. *lineatus lineatus*.
- e'. Central streaks white and broad, lower plumage much darker and not so rufous *lineatus sharpei*.
- C. Lower plumage white, buffy white, or buff with bold bars, or edges of dark brown.
- f'. Lower plumage white ... *nycthemerus nycthemerus*.
- g'. Lower plumage buff or { *nycthemerus ripponi*.
buffy white { *nycthemerus rufipes*.

The above key is one which can only be accepted as a general guide, for in each of the three groups the females resemble one another so closely that it is often difficult and sometimes impossible to distinguish one from the other. The three groups are themselves well separated by the markings of the lower plumage in quite adult birds, but the young females of *B* and *C* are sometimes very

close to one another in appearance until the *nycthemerus* group have acquired the pale, dark margined plumage in part or whole.

GENNÆUS ALBOCRISTATUS.

The White-Crested Kalij.

? *Phasianus hamiltonii*, Gray, in Griffith, ed. Cuvier III., p. 27 (1829); id. Ill. Ind. Zool. I., Pl. 41 (1830).

Phasianus albo cristatus, Vigors, P. Z. S., p. 9 (1830); Gould, Gen. B. H., Pls. 66-67 (1832).

Euplocamus albo cristatus, Hutton, J. As. Soc. Beng. XVII, pt. II, p. 898 (1848); Blyth, Cat. Mus. Asiat. Soc., p. 244 (1849).

Euplocamus albo cristatus, Adams, P. Z. S., p. 499 (1858); Elliot, Mon. Phas. II, Pl. (1872); Hume and Inglis, St. Feath. V., p. 42 (1877); Hume, ibid, VII, p. 429 (1878); Hume and Marsh, Game—B. I., p. 177, Pl. (1878).

Euplocamus albicristatus, Oates, ed. Hume's Nest and Eggs III, p. 413 (1890).

Gallophasis albo cristatus, Mitch., P. Z. S. (1858), p. 544, Pls. 148, fig. 1 and 149, fig. 3; Jerd., B. of In, III, p. 532 (1863); Hume, Nest and Eggs, In. B., p. 526 (1873); Marsh, Birds' Nests Ind., p. 58 (1877).

Gennæus albo cristatus, Ogilvie-Grant, Cat. Birds B. M. XXII, p. 298 (1893); id. Hand—L., Game—B. I, p. 258 (1895); Stuart Baker, Jour. B. N. H. S., XXIII, p. 666 (1915).

Gennæus albicristatus, Oates, Game—B. I, p. 324 (1898); Blanf., Fauna B. I. Birds IV., p. 89 (1898); Oates, Cat. Eggs B. M. I, p. 54 (1901); Rattray, Jour. B. N. H. S. XVI., p. 663 (1905); Ghigi, Mem. Acad., Bologna (6), V., p. 145 (1908); Magrath, Jour. B. N. H. S. XVIII., p. 298 (1908); "Pine Marten," ibid, XIX., p. 796 (1910).

Vernacular Names.—Kalij, Kukera, Mirghi Kalij, Kulesur ♂, Kalesi ♀ (*Hin*, In various parts of the N. W. Himalayas) Kolsa, (Western Punjab and Chamba).

Description—*Adult Male*.—Forehead, feathers above the eye, cheeks, nape and neck black glossed with purplish-blue. Long hairy crest white or dirty pale brown, the feathers next the forehead and sides of the crown mixed with darker brown and black, so that these parts merge into one another rather than contrast. Feathers of the upper back like the neck, but more blue than purple in sheen and with dull edges of pale brown or whitish. Lower back, rump and upper tail-coverts black glossed with steel-blue and with broad edges of pure white generally divided from the black by a very narrow band of brown. Tail feathers above glossy blue-black, below dark brown, sometimes with pale tips. Chin, throat and foreneck dark brown with pale shafts, gradually changing into grey on the lower foreneck, which has a pale steel-blue sheen, and again into white tinged more or less with brown on long lanceolate feathers of the breast and flanks. Abdomen, vent under tail-coverts dull brown, more or less edged paler and not distinctly defined from breast or flanks. Lesser and median wing-coverts like the feathers of the back, and like them with nearly white shafts and two fairly well-marked areas of green and blue gloss; greater coverts with a

greener gloss and visible shafts dark. Quills dark brown glossed on the visible portions with green.

The feathers of the breast are all brown at the base, and shew up in varying degrees, so that in some birds the breasts appear almost pure white, whilst in others they appear almost more brown than white.

Colours of soft parts.—

"Legs and feet pale drab; bill pale horny green, cere dusky; bare face space crimson, irides deep brown." (Davison).

"The irides are orange brown; the bare eye patch bright scarlet to deep crimson, dotted over with numerous tiny tufts of abortive black feathers; the bill greenish white, dusky at tip; the legs and feet livid white, with a purplish or brownish tinge, varying to pale brown. often with an olive tinge." (Hume).

I have also had the legs described to me as being of a rather pale slaty or plumbeous colour.

Measurements.—Length about 27" (685.8 mm.); wing from 8.5" to 9.8" (215.9 to 248.9 mm.); average of forty birds 9.05" (229.8 mm.); tail from 9.0" to 12.5" (228 to 327 mm.); tarsus about 3.1" (78.7 mm.); bill at front about 1" (25.4 mm.), and from gape 1.4" (35.5 mm.). The crest runs up to 4½", and is generally about 3" to 3½" (76.2 to 88.9 mm.).

"Length, 24.0 to 29.0; expanse, 28.75 to 32.0; wing, 8.7

"to 10.0; tail from vent, 10.2 to 13.0; tarsus, 2.9 to 3.1; bill

"from gape, 1.3 to 1.55; weight, 2-lbs. to 2-lbs. 6 ozs."

(Hume).

Adult Female.—Feathers of the head, including crest, reddish hair brown, the shafts but little paler than the webs. Wing-coverts and the whole of the neck and back the same brown, but with each feather broadly edged with very pale brown and with the shaft pale enough to contrast strongly with the webs. Wing quills brown with the shafts the same colour except on the innermost, which have them a little paler than the webs; the whole of the back and wings finely vermiculated with black, the vermiculations being somewhat stronger towards the tip than at the base of each feather. Central tail feathers reddish brown, more broadly vermiculated with black and with a few buff or whitish vermiculations on the outer edges of each web; sometimes extending over the whole of the outer webs. Remaining tail feathers dark brown, glossed with green, and generally with paler tips, whilst one or two pairs next the central ones often have edges similar to these. Lower plumage similar to the upper, but paler and with broader pale edges to the feathers; chin and throat palest and dullest, and centre of breast darkest and richest in colouration; centre of abdomen and vent dull grey-brown, pale and feebly marked.

The females vary a good deal in tint, and a few are markedly more grey, especially on the wing quills and scapulars.

Colours of soft parts are similar to the same parts in the male, but generally duller. The crimson of the bare parts of the face is duller and darker, more a brick-red than a true crimson or scarlet red; the irides are brown, or orange-brown; legs and bill much the same as in the cock bird.

Measurements.—The female is generally a good deal smaller than the male, but varies very much in size. Wing from 8" to nearly 9" (203.2 to 226.5 mm.); average of thirty-three birds, 8.3" (210.8 mm.); tail from 7.8" to 9.1" (198.1 mm. to 229.0 mm.); tarsus about 2.6" (66 mm.); crest about 3" (76.2 mm.) or a little over.

"Length 20.0 to 23.0; expanse 24.5 to 27.2; wing 8.0 to 8.3; tail from vent 7.8 to 9.0; tarsus 2.6 to 2.8; bill from "gape 1.2 to 1.3; weight 1 lb. 4 ozs. to 2 lbs. 4 ozs." (Hume).

Young Male.—Similar to the female.

Chick in first plumage has the crown chocolate brown, with the sides of the head and crown rufous, pale on former, rich and somewhat chestnut on the latter; ear-coverts dark-brown; upper plumage brown, minutely freckled with black, each feather with paler edging, a conspicuous white spot at the tip, and a broad sub-terminal bar of black edged with rufous; wing-coverts like the back. Lower plumage dull pale brown, the feathers with whitish shafts and pale edges.

Distribution.—Along the Himalayas from the River Indus on the West to Nepal on the East, possibly entering the extreme West of Nepal as far as the Gogra. Hodgson obtained a skin from West of Jamla, presumably in Nepal, but with no definite locality, and Hume thought that it must have come from still further West, probably from the Kumaon or Garhwal Hills, where it is very common.

It has been said to extend West into Buneer and Swat, but it is very doubtful if this report is correct, for the country is certainly not suited to the habits of these birds.

Migration.—The White-Crested Kalij breeds according to locality from the end of March and early April to the end of June. From 2,000 feet to 4,000 feet or so most nests will be found during April, but at 3,000 feet not many will be taken until well on into May, and in the highest parts of their breeding ranges their eggs may be found as late as the end of June. They certainly breed up to 9,000 feet and over, and probably up to some 11,000 feet in parts of Kashmir. Magnan records it as a resident bird at Thandiani at an elevation of 9,000 feet, and Dodsworth found it breeding at over this height in the Simla Hills and Native States, whilst

Wilson took its eggs at 9,500 feet in the Bhagiruttee Valley. Hume found it, on the other hand, breeding as low down as 1,200 feet in the Dhoon, and doubtless it may be found at even lower elevations than this.

The nest is much the same as that of all others of the genus, *i.e.*, generally nothing more than a collection of leaves, grass and forest rubbish in some hollow under the shelter of a bush, tree or bamboo clump. In many instances this heap of rubbish is merely what has fallen and drifted into its present situation, but sometimes apparently the bird does go to some trouble in scratching together the material on which to deposit its eggs.

Mr. Frederick Wilson, so well known under the nom-de-plume of "Mountaineer", in an interesting letter to Hume writes about the breeding of this pheasant in Garhwal as follows:—

"The Kalij Pheasant (*murghi* or *kookera* of the Paharis) is found from the foot of the hills, or rather from the Sewalik Range to the Snows, and consequently breeds at all elevations up to 9,000 feet in a few localities even higher; I lately found the nest above the village of Sookes in the Bhagirattee Valley, which must have been at 9,500 feet. In the Dhoon, at the foot of the hills in the lower Valleys the Kalij begins to lay in April. In the higher ranges it lays in May, and some birds not till the beginning or middle of June. The nest, if it can be called such, is generally in a coppice where there is plenty of underwood, and under an overhanging stone, or thick low bush, or tuft of grass. It is merely a hole scraped in the ground. The eggs are 9 to 14 in number, very like those of some domestic fowls, a yellowish or buffy white. Both parent birds are generally found with the young brood. Occasionally very late broods would lead one to infer, either that the Kalij sometimes has two broods in the year, or that when a nest is destroyed, they commence the business of incubation over again."

Other observers' remarks agree well with Wilson's description of their breeding, but Major Cook once found its nest on a large low bough of a tree in a hollow on the upper side of which the eggs were placed.

The only two things which seem to be an absolute necessity in this Pheasant's estimation in the nesting site is ample cover and water within a reasonable distance. Thin forest with thick undergrowth, evergreen forest with plenty of ferns, brambles and bracken, ravines and water courses with rocky sides well covered with weeds, &c., all seem to form equally suitable places for the nest, and in addition to these it may be sometimes found in bamboo jungle, especially if there is a certain amount of grass or scrub mixed with

it. According to Hume, the White-Crested Kalij sometimes makes quite a respectable nest. He remarks:—

"The Common Kalij hardly forms a regular nest. It gets together a pad, sometimes rather massive, sometimes very slight, of fine grass and coarse moss roots, mingled with a little grass or a few sprigs of moss, and in a slight depression; in this it lays its eggs. One which I measured *in situ* in May, 1871, in the Valley of the Sutlej, just below Kotegurh, was circular, 11·5 in diameter and 4 inches in thickness outside, with a central depression 6 inches wide and nearly 2 inches in depth in the centre."

The number of eggs generally laid is, 6 to 9, but they sometimes lay as many as 14, and also sometimes as few as 4, as the late Mr. P. Dodsworth took this number of eggs very hard set. 8 or 9 eggs is probably the number most often to be found in a complete clutch.

In general appearance they are exactly like the eggs of the domestic fowl, but are, perhaps, on the whole more glossy, and are frequently somewhat pointed. The surface is very smooth with a fine, close grain, but sometimes they are pitted with innumerable little pores, though these are not normally nearly so numerous or so conspicuous as those almost invariably found in the eggs of the Peacock Pheasant.

The colour may be anything from a white merely tinted with cream or buff to a buff of a rich red tone like that of the darkest eggs laid by a Brahma fowl, but even redder than these. The majority of eggs laid are a warm cream or reddish buff, and eggs almost white are quite exceptional.

The series of 60 eggs in the Hume Collection in the British Museum vary in length between 1·85" (44·0 mm.) and 2·05" (52·07 mm.), and in breadth between 1·25" (31·7 mm.) and 1·55" (39·4 mm.). All the eggs which have passed through my hands come within these extremes, and including the 60 in this Collection the average of 100 is exactly 1·95" (49·5 mm.) by 1·42" (36·1 mm.).

Whether the White-Crested Kalij is polygamous or not seems still to be a moot point, and it is quite possible that though it is generally speaking monogamous, it sometimes indulges in monogamistic habits. Hume is strongly of opinion that it is a libel upon this bird to accuse him of having more than one wife, and says that he has many hundreds of times flushed young broods in company with both parents, and that from the month of May to that of October he has rarely put up an adult of one sex without finding the pair to it close by,

"*Onithognomen*," however, who wrote regularly for the *Field* in

the early sixties, and was a sportsman and observer of wide experience and considerable ability, recorded :

"The Kullij is polygamous (as indeed all Gallinaceous birds are), and its habits with respect to breeding are exactly the same as those of the Jungle-Fowl. The cock bird pays tolerably impartial attention to his seraglio of 3 to 5 hens, and the latter, when so disposed, retire from time to time to some secluded, sheltered spot to lay, returning to their party when this little duty has been performed. When 6, 8 or 10 eggs have been laid in one spot, the hen yields to the impulse of incubation, and withdraws from Society to hatch her brood."

It must be remembered that in "Onithognomen's" day it was an accepted idea that all game birds were polygamous, and the barn-door fowl was cited as the pattern followed by the rest in their domestic habits. Of recent years, however, it has been satisfactorily proved that in many instances the cock birds of many species prove faithful husbands and good parents, and it is not safe to generalise. The credit for polygamy has doubtless arisen from the fact that the cock bird is so often seen with a number of birds in hens' plumage, though this may be due merely to the young cocks not having yet acquired their male feathers and colours.

The young grow their wing quills with extraordinary quickness, and within a few days are able to fly as well and as fast as the adult bird.

The hen bird is a very close sitter, and according to Hume, may often be captured by hand or seized by a dog before she will leave her nest.

General Habits.—The White-Crested Kalij is resident wherever found, though it may move locally higher up the hills in summer and lower down in winter. Even this movement must, however, be but very slight, as it has been found breeding at practically every height at which it has been seen. Typically it is, like the rest of the genus, a bird of heavy forests and thick growths rather than the deciduous forest and more open country of the higher hills. At the same time it is less exclusively found in dense evergreens than are its nearest relations, and sometimes at least it wanders on to hill sides covered with but broken patches of tree and bush scrub, especially if the intervening portions are well furnished with bracken. Of course this does not mean to infer they do not feed regularly, morning and evening, in the open, and indeed when the weather is cool and showery especially at the higher elevations, it may be found in open places throughout the day.

It is not nearly so socially inclined a bird as the Jungle-Fowl, and is seldom met with except in pairs or small family flocks of

half a dozen to a dozen, but may sometimes be seen in the company of Jungle-Fowl, and sometimes two or three old cocks will be found together after the breeding season is over.

During the breeding season they are said to be very pugnacious. "Mountaineer" writes:

"The Kalij is very pugnacious, and the males have frequent battles. On one occasion I had shot a male, which lay fluttering on the ground in its death struggles when another rushed out of the jungle and attacked it with the greatest fury, though I was standing re-loading the gun close by. The male often makes a peculiar drumming noise with its wings, not unlike the sound produced by shaking in the air a thick piece of cloth. It is only heard in the pairing season; but whether to attract the attention of the females or in defiance of his fellows I cannot say, as I have never seen the bird in the act, though often led to the spot where they were by the sound."

The sound is undoubtedly one resorted to as a challenge to fight, and in some parts of its habitat it is imitated as a decoy to entice the male birds into snares and traps.

Nowhere do these birds exist in sufficient numbers now-a-days to make their pursuit worth while unless other game can be bagged at the same time. When this is the case they are well worth working hard for, as they are strong fast fliers when fairly on the wing, take a lot of bringing down, and when killed are excellent for the table.

Hume remarks that:—

"Generally in the hills you may pick up three or four birds in a day, by beating all likely patches of cover near fields, but it is rare with this species to make a good bag. There are, however, places where you may come across the Kalij almost as thick as Pheasants in a Norfolk cover. Such places there used to be close to Bhim and Naukuchia Tal, small lakes not far from Naini Tal, but at a much lower level, and at the former of these I once, early in November, killed eleven and a half brace in less than three hours."

Wilson writes of this Kalij as a very tame and confiding sort of bird; he says:

"It appears to be more unsuspicious of man than the rest of our Pheasants; it comes much nearer his habitations."

And again:

"They are never very shy, and where not unceasingly annoyed by sportsmen or shikaris, are as tame as any sportsman could wish."

Since the days when Wilson wrote the Kalij has evidently learnt its lesson, and now one requires plenty of patience and hard work to be

expended before he can be brought to bag, especially without good dogs. Wandering along roads and forest paths in the early morning or late afternoon, one may sometimes obtain quite a decent bag of these birds, for wherever the road passes through forest, Kalij Pheasants are quite sure to frequent it daily. If the road is wide and runs straight for considerable distances, it is not much used attempting to shoot along it, and the only chance is to creep along as quietly as possible just inside the edge of the forest and *hope* to spot your game before he sees or hears you. On the other hand if the road twists and turns so as to enable you to get fairly clear to any bird hunting for grain in the droppings, &c., on it, one can get quite a number of shots in a couple of hours' stroll. This is not however a very satisfactory way of shooting, for if you want your bird, it is almost imperative to shoot him as he runs into safety, and not one bird in five will give a decent shot on the wing unless he is startled into unwilling flight by your almost treading on him.

If, however, you know his haunts and have good dogs to work them with, it is possible to have a much more sporting day's shoot, but it must be remembered that Indian forests are not like English ones, there are no nicely cut drives or open spaces, and ten to one when the bird is put up by your dogs he gets up and keeps up right out of sight. A more or less open ravine may sometimes furnish a vantage ground for the sportsman, giving him room to work uphill and see more or less what is going on above him on either side. It is best always to work uphill, as all Kalij Pheasants, like Jungle-Fowl, always run away uphill, but once they are flushed turn and fly downhill. Once on the wing and fairly started, they fly at a great pace, and it is no easy matter to get your first bird as they come towards you and then swing round and bowl over your second before he passes out of shot.

When shooting with dogs, pheasants often fly into trees and perch, and once seated in what they consider safety, it is generally possible to creep up and get a fair shot as they leave their perch.

The White-crested Kalij feed greedily on all kinds of grain and seed, and also on the tender young shoots of many green crops. Cultivation of almost any sort, therefore, forms a great attraction to them, and this is probably why they are more numerous round and about villages than in more remote forests. At the same time even the crops of villages will not tempt them unless there is plenty of heavy forest within the immediate vicinity into which they can scuttle for refuge. In addition to vegetable food they will eat almost any kind of insect, worms, larvæ and even small reptiles.

The cocks have a rather loud crow or call, described by Wilson as "a loud whistling chuckle or chirrup," and both sexes chuckle and cluck in a soft undertone as they wander about in the undergrowth scratching for food.

GENNÆUS LEUCOMELANOS.

The Nepal Kalij.

Phasianus leucomelanos, Lath., Ind. Orn. II., p. 633 (1790).

Euplocamus leucomelas, Hodg., in Gray's Zool. Misc., p. 85 (1844).

Gallophasius leucomelanos, Gray, Gen. B. III., p. 498 (1845); Hutton, J. A. S. B., XVII., pt. II., p. 694 (1848).

Euplocamus leucomelanos, Hume, Str. Feath. VII., pp. 428-9 (1876); Hume and Marsh, Game-B. Ind. I., p. 285, Pl. (1878).

Gallophasius leucomelanos, Scully, Str. Feath. VIII., p. 345 (1879).

Gennæus leucomelanos, Ogilvie-Grant, Cat. Birds B. M. XXII., p. 380 (1893); id. Hand-L. Game-B. I., p. 262 (1895); Oates, Man. Game-B. I., p. 329 (1898); Blanford, Fauna. Brit. Ind. IV., p. 90 (1898); Stuart Baker, Jour. B. N. H. Soc. XXIII., p. 667 (1915).

Gennæus leucomelanos, Ghigi, Mem. Acad. Bologna (6), V., p. 145 (1908).

Vernacular Names.—Kalich, Kalij (*Perbuttia*), Rechabo (*Bhutea*, *Nepal*).

Description.—*Adult Male*.—Similar to *albocristatus*, but with the crest glossy blue-black with no trace of white or of pale brown. The feathers of the lower back, rump and upper tail-coverts are glossy, blue-black with narrow white edges divided from the black by a very fine bar of brown vermiculations. The wing-coverts have narrower white edges than are found in the White-Crested Kalij, and these are often in the shape of white vermiculations rather than in one distinct bar. The chin and foreneck are darker and more glossy, and the under parts are generally a little less albescent, though this feature is not sufficiently developed to be of any real value.

Colours of soft parts, as in *albocristatus*. Hume describes the legs and feet thus:—

“Legs and feet pale brownish or dingy greyish horny; the
“toes usually a little darker than the tarsus; claws brownish
“horny, spurs dusky.”

Measurements.—Length about 25" (637.0 mm.); wing 8.1" to 9.2" (204.7 to 233.6 mm.); average of thirty-five birds, 8.3" (210.8 mm.); tail 8.9" to 12.0" (248.9 to 304.8 mm.); tarsus about 3.1" (78.7 mm.); crest 2.5" to 3" (71.1 to 76.2 mm.). Hume gives the weight, as varying between 1-lb. 12-ozs. and 2-lbs. 8-ozs.

Adult Female.—Differs but little from the female of the White-Crested Kalij, but is on the whole rather redder and more richly coloured, and this more particularly so on the tail and the under parts. The feathers of the breast have quite dark centres such as are never found in *albocristatus*, and the general darker tint of the centre of the feathers of both upper and lower plumage makes the contrast with the pale edges more striking than it is in that bird. Scully says that:—

“The adult female resembles that of *melanotus* much more
“closely than it does that of *albocristatus* or *horsfieldi*. It

"differs from *melanonotus* in having the feathers of the upper surface more broadly margined with greyish white; the middle tail feather more broadly vermiculated, though not so prominently as in *albocristatus*; the edges to the feathers of the lower surface contrast more and the rump contrasts more with the middle tail feathers, in this respect resembling *horsfieldi*, but in no other."

Colours of soft parts as in *albocristatus*.

Measurements.—Length about 20" (508 mm.); wing 7·8" to 8·7" (198·1 to 221·0 mm.); average of twenty birds, 8·1" (205·7 mm.); tail 7·3" to 8·6" (185·4 to 218·4 mm.); tarsus about 2·7" (68·5 mm.); crest about 2·5" (63·7 mm.).

Chick in down.—Head chestnut, palest on forehead and behind eye; a dark streak running from behind and below eye to neck. Centre of back chocolate brown with broad lateral bands of pale buff, sides dull chestnut; chin and throat pale yellowish white, remainder of lower parts pale yellowish grey.

Young.—A chick captured on the 10th June, whose wing measured only 2" had the feet orange and the bill greenish yellow-horny; the head was rufous-brown, the body above dark brown; each feather of the wing-coverts and scapulars having a blackish subterminal bar, and a fulvous tip; beneath sullied fulvous. Young birds of both sexes about three months old resemble the female, but have the bill livid at tip, the orbital skin pale fleshy red, and the feet livid brownish; at this stage the black subterminal bars on the upper feathers are still well marked. The young male assumes the black plumage when about five months old (such, at least, was the case in two specimens I had in confinement); but at this age it still shews traces of the original brown colour about the feathers of the neck and upper back." (Scully).

Distribution.—Nepal at practically all heights between 2,000 and 9,000 feet. In the extreme West of Nepal across the Gogra it is doubtful whether this species may not be replaced by the White-crested Kalij, and again, in the extreme East of Nepal it is possible that the Black-backed Kalij may be found.

Scully writes that the Nepal Kalij extends as far East as the Arun River, and this is probably correct; certainly birds which I procured at Jalpaiguri, and which had come from the vicinity of Dhamkhata were all *melanonotus*. Dhamkhata is a village on the Tamra, a small stream running into the Arun River, and the birds were procured for me by Nepalese who traded in Pankabari and Jalpaiguri. It is interesting to note, also, that these birds shewed no signs of grading into *leucomelanus*. It is true that one or two shewed white lines on the edges of the rump feathers, but I find

that this is a feature which crops up here and there throughout the whole range of *melanonotus*.

Nidification.—As far as I can ascertain there is nothing authentic on record about the breeding of this Pheasant. Scully says nothing about their nesting habits. Hume says:

“The habits and nidification of this species are, of course, very similar to those of the other Kalij Pheasants.”

This, however, in so far as it relates to the nidification is merely guess work on Hume's part, though undoubtedly correct. Ogilvie-Grant says of the nest and eggs “very similar to those of *G. albocristatus*”, a statement very possibly founded on Hume's.

There are no eggs of this species in the British Museum, nor did Hume ever obtain any, and I think the first eggs ever taken were two brought to a Mr. Ferry by Nepalese from the hills immediately above Bettiah. These were given by him to Dr. H. N. Collart, who in turn made them over to me. Later I obtained a second clutch of five eggs from the same place together with the skins of the females.

In appearance the eggs cannot possibly be distinguished from those of the other Kalij Pheasant; the surface, texture and shape are all quite normal. In size they vary in length between 53.1 mm. and 46.2 mm., and in breadth between 34.2 mm. and 31.1 mm., the average of eighteen eggs being 50.4 mm. by 33.6 mm. The two clutches were taken on the 23rd May 1908, and 25th June 1907, respectively.

Habits.—The Nepal Kalij Pheasant is a bird of comparatively high elevation, for though in the cold weather it wanders down to some 2,000 feet and even to the foot hills still lower than this, it is most common between 4,000 and 6,000 feet, seldom breeding below the former level, whilst it is common up to 9,000 feet and perhaps even higher.

Hodgson has left little on record about this Pheasant, and was in fact somewhat doubtful as to its status. He remarks:

“This is by far the commonest Pheasant in Nepal. Its range is the central region; it is never found in the Terai, seldom in the Cachar (the most elevated portions of Nepal). Where *Gallus ferrugineus* ends there the Kalij begins and extends, though in diminishing numbers, to the region of the Monal and the Tragopan.”

The notes of Scully in “Stray Feathers” written in 1880 are still practically the only record we have of this bird's habits, and are quoted as follows:

“*G. leucolanius* is common, wherever thick forest is found, from Hetoun in the Dan to the Valley of Nepal; in all the wooded hills surrounding the latter up to an elevation of nearly 9,000 feet; and in every forest about Neakote. It is

"usually seen in pairs or in parties of from 3 to 10, often feeding on the ground near cultivated patches at the border of forest. The birds seem very fond of perching on trees, and it is usually in this position that one comes across them in forcing one's way through forest which has a dense undergrowth. On such occasions the Kalij first gives notice of its whereabouts by whirring down with great velocity from its perch and then running rapidly out of sight to the shelter of some thicket. In the winter the birds roost on trees at the foot of the hills, and the plan for making a bag is to post oneself about sunset under some trees which they are known to frequent and to await their coming. The birds are then soon heard threading their way through the jungle to their favourite trees, and at once fly out and perch. When once settled for the night in this way they are not easily alarmed, and I have shot 4 or 5 birds in quick succession before the rest of the party would clear out to quieter quarters.

"Occasionally too one can get a shot at the Kalij as they cross a hill path through the forest on their way to or from some streams.

"Great numbers of the Nepal Kalij are snared and brought into Khatmandu for sale; the birds bear confinement in the valley very well, and I reared several chicks to maturity."

GENNÆUS MELANONOTUS.

The Black-backed Kalij Pheasant.

- ♂ *Phasianus muthura*, Gray, in Griffiths' Ed. Cuv. III., p. 27 (1829).
 ♀ *Gallophasias muthura*, Gray, Gen. Birds III., p. 498 (1845).
Euplocamus melanonotus, (Blyth) Hutton, J.A.S.B. XVII., pt. II., p. 694 (1848) (Darjeeling); Blyth, Cat. Mus. As. Soc., p. 244 (1849).
Gallophasias melanonotus, Mitchell, P.Z.S. (1858), p. 544, Pl. 149, fig. 2; Jerdon, B. of Ind. III., p. 534 (1863); Hume, Nests and Eggs, Ind. B., p. 527 (1873); Marshall, B. Nests Ind., p. 59 (1877).
Euplocamus melanonotus, Hume and Inglis Str. Feath., V., p. 42 (1877); Hume, *ibid* VII., p. 429 (1878).
Euplocamus melanonotus, Hume and Marsh., Game-B. Ind. I., p. 191 (1878); Oates, ed. Hume Nests and Eggs III., p. 415 (1890).
Gennæus muthura, Ogilvie-Grant, Cat. Birds B.M. XXII., p. 301 (1893); Ghigi, Mem. Acad. Bolongna (6), V., p. 145 (1908).
Gennæus melanonotus, Ogilvie-Grant, Hand-L. Game-B. I., p. 268 (1895); Oates, Man. Game-B. Ind. I., p. 331 (1898); Blanf., Fauna B.I. IV., p. 91 (1898); Oates, Cat. Eggs B.M. I., p. 54 (1901); Stuart Baker, Jour. B.N.H. Soc. XXIII., p. 668 (1915).

Vernacular Names.—Kar-Rhyak (*Lepcha*).

I follow Blanford in refusing to accept *muthura* as the specific name for this Pheasant. The description is that of a bird "the size of a turkey" which is, of course, too big for any of the Kalij Pheasants; this, however, would not debar the name if the description was otherwise sufficient, for there is no doubt it is meant to

apply to one of the Kalij Pheasants, but the description does not suffice and moreover the trivial name employed "The Chittagong Pheasant" would seem to shew that it is equally as likely to be the Black-breasted Kalij as the Black-backed bird. Under these circumstances I retain Blyth's name of *melanonotus* as the earliest certain name for this Pheasant.

Description—Adult Male.—Whole upper plumage black, glossed with deep violet blue, greenish in some lights and slightly purplish in others, each feather from the hind neck to the shorter tail-coverts with an unglossed velvety black edge to the tip, broadish on the rump, and also with white shafts; these white shafts shew up well on the scapulars and upper back, but are often almost entirely concealed on the rump and upper tail-coverts. Longest upper tail-coverts and tail feathers black-glossed with blue-green or green. Wing-coverts like the back; quills brown, the outer secondaries glossed with greenish violet on the outer webs and the innermost glossed with the same on both webs.

Chin and throat blackish brown, the tips of the feathers next the breast gradually becoming paler; the long lanceolate feathers of the breast white with brown bases, the white decreasing and the brown increasing in extent towards the lower breast, abdomen and posterior flanks; vent and extreme centre of abdomen brown; under tail-coverts and thighs blackish brown.

Many fine males have the scapulars and wing-coverts very narrowly edged with white, in some the white being pure and well-defined, and in others more or less broken up with velvety black. In two specimens in the Hume Collection the feathers of the scapulars have small smoky white spots at the tips of the feathers instead of distinct white edges.

The under parts of individuals of this species vary considerably, in some specimens the white portions of the feathers are so extensive that the whole breast appears to be white, whilst in others the brown bases shew through everywhere, giving this part of the plumage a mottled brown appearance.

Colours of the soft parts.—Iris brown, hazel brown to orange brown; facial skin and lappets crimson red, bright red, or crimson; bill yellowish or greenish horny, palest at the tip, and blackish at the base as far as the nostrills; legs and feet pale horny brown, greenish brown or fleshy slate; spur paler than the legs at the base, then darker, and usually with a light tip; the soles are generally pale fleshy slate colour.

Measurements—

"Length 25.0 to 24.0; expanse 26.5 to 29.0; weight 2-lbs. 6-ozs. to 2-lbs. 12-ozs." (Hume).
Wing 8.5" to 9.5" (215.9 to 241.9 mm.); average of forty birds, 8.94" (227.0 mm.). Tail 9.4" to 12.3" (238.7 to 312.4

mm.); average of forty birds, 11.2" (284.4 mm.); tarsus 3.1" to 3.3" (78.7 to 83.8 mm.); spur about .75" (16.9 mm.); bill at front 1.20" (30.5 mm.) and from gape 1.35" (34.2 mm.); crest up to 3" (76.2 mm.); generally about 2½" (63.5 mm.).

Adult Female.—Only differs from the female of *leucomelanus*, in having the nape a less bright chestnut than the crest and upper back, so that when the crest lies down it shews quite plainly against it. On the whole it is like *leucomelanus* perhaps, darker than *alboeristatus*, and has the tail feathers more chestnut.

Colours of the soft parts as in *leucomelanus*.

Measurements—

"Length 18.0 to 21.0; expanse 25.0 to 27.0. Weight

"1-lb. 14-ozs. to 2-lbs. 4-ozs." (Hume).

Wing 7.7" to 8.8" (195.5 to 223.5 mm.); tail 7.9" to 9.2" (200.6 to 233.6 mm.); tarsus 2.7" to 2.9" (68.5 to 73.6 mm.); bill at front about 1.15" (29.2 mm.), and from gape about 1.25" (31.7 mm.) The crest is roughly about 2" (50.8 mm.), and rather scanty.

Young Male in first plumage resembles the female, but is generally darker below.

A young bird of a few months old—probably about three—has the greater and median wing-coverts reddish brown with fine bars of black vermiculation, a broad bar of black near the tip, then a bar of chestnut with one fine bar of black on it, and finally a white tip; a few feathers of the back and scapulars have bold black bars; the rest of the plumage is that of a very dull adult female.

Distribution.—From the extreme West of Sikkim and over the greater part of Western Bhutan. Its exact boundaries both East and West have not hitherto been defined. To the West the Arun River in Nepal is *probably* its Western boundary, for, as already recorded, some birds sent me from a small Eastern tributary of this stream were all of this species. At the same time exact data of native-collected specimens are always to be regarded with caution. In this instance they are probably correct, as they were alleged to have been trapped within a short distance of the village to which the Nepalese belonged. The birds found in the hills North of Jalpaiguri are all typical *melanonotus*, but North of Goalpara one gets into the range of *horsfieldi*, though birds of this district often shew traces of white on the breast, as is, however, the case throughout the whole of the range of typical *horsfieldi*. These are the birds named *mearsi* by Oates, the type of which was killed at Nanywa, Chin Hills.

Nidification.—The Black-backed Kalij breeds from late in March up to the end of June, but eggs may also be taken a good deal earlier than this, and also later. In the lower elevations at which these Pheasants bred, say from 1,500 to 3,000 feet, March and

April are the two months in which most eggs are laid; from 3,000 to 4,500 feet, the 25th April to end of May or early June are the favourite breeding months, whilst in the highest ranges they breed from May to the end of June, or even July, and I have had hard-set eggs sent me which were taken in August below Darjeeling.

The nest is generally a very poor affair, nothing more than a collection of dead leaves and grass gathered together by chance—less often by the birds themselves—lying in some natural hollow under the protection of a bush or tree. They are also sometimes found in bamboo jungle, and in these cases the birds seem to scratch a hollow in the ground, and fill this with bamboo spates and leaves, then they work a hollow in the centre of these for the reception of their eggs. I have never seen a nest of this species myself, but all my correspondents agree that the nests are almost invariably very well concealed; favourite positions for them are either in ravines, in dense evergreen forest, or in the almost impenetrable secondary growth, which in a couple of years covers deserted cultivation. When bamboo jungle is selected, it is nearly always very closely growing, and the eggs are deposited well in amongst the roots, so that they are not easily spotted.

They also sometimes make their nests in among tea-bushes in Tea Gardens after these have come into full flush, and the undergrowth has sprung up again so as to afford sufficient cover. I imagine, however, that few of these clutches of eggs ever hatch out, for now-a-days tea is so highly cultivated that the weeds are constantly hoed out, and the eggs are then discovered and eaten by the coolies. At the same time there is yet plenty of land in the Terai all round about the Tea Estates which is too broken up to be worth cultivating for tea, and here the Kalij still flourishes and breeds without much molestation, for the small native boy does not emulate his white brother in his birds' nesting proclivities. Thus Hume's fear that within a few years of his writing his "Game-Birds," the Black-backed Kalij would become very rare, has fortunately not been fulfilled.

The eggs vary in number from 6 to 10, 7 or 8 being the numbers most often found. They differ in no way from those of other Kalij Pheasants, that is to say, they are very similar to the eggs of the common domestic fowl. In colour they vary, as do these, from practically pure white, as recorded by Tickell, and seen also by myself, to a warm, rich café-au-lait or buff, whilst they cover the same differences in shape, being normally a broad oval, but slightly compressed at the smaller end. The texture is that of a fowl's egg, usually quite smooth and slightly glossy, sometimes pitted, sometimes having the tiny white specks occasionally found in most game-birds' eggs.

The eggs I have seen, including Hume's series in the British

Museum, vary in length between 1.76" (44.0 mm.) and 2.05" (52.0 mm.), and in breadth between 1.36" (34.5 mm.) and 1.54" (39.1 mm.), the average of 58 eggs being 1.92" (48.7 mm.) by 1.47" (37.3 mm.).

Habits.—The Black-backed Kalij is a bird of somewhat lower elevations than either of the two preceding birds, but at the same time is not normally found at so low an elevation as that haunted by the Black-breasted Kalij. It is most numerous at 2,000 feet to 5,000 feet, but is common enough round about Darjeeling and in the interior of Sikkim up to 6,000 feet, and perhaps even higher than this in the hot weather. At 7,000 feet, however, it is only a casual wanderer, though it has been met with up to 8,000 feet. Beavan, on the other hand, found it at Pankabari at the foot of the hills (where it has been known to breed), and the natives say that in the winter it wanders into the broken land in the Tea Gardens, though the planters themselves say it is but rarely they come across one when out shooting.

Higher up amongst the Tea Gardens in the Darjeeling Terai it is still extremely abundant in many places bordering the non-cultivated areas. Here there are wide extents of land planted with tea, broken up and surrounded by ravines, steep hillsides and rugged pockets, either retaining their original virgin forest or with this replaced by a matted growth of secondary jungle even thicker than the other. These patches are a very favourite resort of the Kalij, not only on account of the protection given by their dense cover, but on account of their bordering the tea lands, which furnish good feeding grounds, and the crops of the native cultivators, of which they take due toll.

But if these places afford refuges to the birds from the encroachments of civilization, they also form, in a way, traps which lead to their destruction, for they are comparatively easy to beat, and are thus often worked by sportsmen in pursuit of them.

When the ravines and hillsides are beaten, the birds on flying out always follow two rules; firstly, they invariably make for the heaviest forest near by, and secondly, when there is a choice between two or more similar forests, they choose the one which will enable them to fly downwards.

Although I have never heard of big bags being obtained in this way, a couple of guns in a morning's beat will sometimes pick up 3 or 4 brace in addition to other odds and ends that the beaters flush.

• Like all the Kalij Pheasants, it is a tremendous runner, and when worked with beaters only, will seldom rise until it reaches the very edge of the forest or bushes, when it gets up with a rush and a flurry of wings, soon getting up a considerable pace. If flying downhill, it alternately sails and flies with rapid beat of wings until

it sails out of sight, drops to the gun, or descends headlong into the sanctuary of the further forest. With dogs it gets up quicker, and often perches, and if the dog distracts its attention, will then often allow the gunner to walk right up to the tree before it quits by the opposite side.

In the mornings and evenings it comes into the open to feed, both in cultivation and along the edges of roads and forest paths; in these and similar places it often affords a running shot as it scurries away on being disturbed, but it is exceptional for it to take to flight under such circumstances unless rushed by a dog.

Writing half a century ago, Gammie speaks of the Black-backed Kalij as of a shy bird, but now-a-days, it appears to be just as wild and as clever as any of its near relations in avoiding the sportsman. Gammie writes:

"Usually it is a silent bird, but when suddenly alarmed, it utters a sharply repeated '*koorchi koorchi koorchi*' as it rises on the wing. When, however, the males are in the fighting humour—which they usually are about breeding time—their call, as they advance towards each other, '*koor koor*' '*waah waah*'; the former being the threatening and the latter the attacking note. They also at times answer each other's call in the jungles.

"In fine weather the male often makes a sharp drumming noise by beating his wings against his sides, somewhat after the style of the wing flapping of the domestic cock preparatory to crowing from some elevated place; but instead of the cock's few leisurely flaps, the Kalij strikes oftener and smarter producing a sound more like drumming than flapping. From the same spot he repeats the noise twice or thrice at short intervals, but gives no voice along with it. It seems as though he was in such a joyful mood that he must give expression to his delight somehow, but inherited experience had effectually taught him that any attempts at crowing in the jungle was likely to attract the attention of wild beasts, and that he must stick to his drumming and leave the crowing part to the domestic cock, who can safely indulge in that amusement.

"The natives look on the drumming of the Kalij as a sure sign of approaching rain. It is heard at all seasons of the year, but most frequently before the setting in of the rainy season; at other times generally just before a fall of rain.

"The food of the Kalij is varied in the extreme. It eats almost everything in the shape of seed, fruit and insects, but is particularly fond of the larvæ of beetles out of cow-dung and decayed wood, and several of the jungle yams which bear tubers along their vines at the axils of the leaves. When the

"vine tubers are exhausted, it will scratch away the soil to get
"at those underground."

Gammie considers the flesh poor eating, but most sportsmen in India are pleased enough to get it for the table, especially in out-of-the-way spots where variety in food is not easily obtainable. Old cocks are, of course, tough, but young birds in the autumn are excellent eating; like all Indian Pheasants, they should be eaten as soon as possible after being killed, unless the weather is cold enough to allow of their being kept some days.

They are quite easy to keep in captivity once they have got over the first few days, during which they must be carefully watched to prevent them dashing themselves against the sides of their cage, and so killing or maiming themselves.

GENNEUS HORSFIELDI HORSFIELDI.

The Black-breasted Kalij Pheasant.

Gallophasid horsfieldii, Gray, Gen. B. III., p. 498, Pl. CXXXVI (1845).

Euplocamus horsfieldi, Blyth, Cat. Mus. As. Soc., p. 244 (1849); Hume, Str. Feath. VII, p. 429 (1878).

Euplocamus horsfieldi, Hume and Inglis, Str. Feath. V, p. 42 (1877); Hume and Marsh., Game-B. Ind. I., p. 198, Pl. (1878); Fasson, Str. Feath. IX, pp. 203-5 (1880); Hume, Str. Feath. XI, p. 303 (1888); Oates, ed., Hume's Nest and Eggs, III, p. 416 (1890).

Euplocamus cuvieri, Hume and Marsh., Game-B. Ind. I, Pl. only (1878).

Genneus prendergasti, Oates, Jour. B. N. H. S. XVII, p. 10 (1906); Ghigi, Mem. Acad. Bologna (6), V., p. 144 (1908).

Genneus batemani, Oates, Jour. B. N. H. S. XVII, p. 11 (1906); Ghigi, Mem. Acad. Bologna (6), V, p. 145 (1908); Harington, Jour. B. N. H. S. XX, p. 327 (1910).

Genneus mearsi, Oates, Ann. Mag. N. H. (8), V., p. 164 (1910).

Genneus horsfieldi, Ogilvie-Grant, Cat. Birds B. M. XXII, p. 302 (1893); id, Hand-L. Game-B. I, p. 269 (1895); Blanford, Fauna, B.I. IV, p. 92 (1896); Oates, Man. Game-B. Ind. I, p. 334 (1898); Stuart Baker, Jour. B. N. H. S. XII, p. 487 (1899); Inglis, ibid, p. 676 (1899); Oates, Ibis (1903), p. 102; id, Cat. Eggs, B.M. I, p. 55 (1901); Stuart Baker, Jour. B. N. H. S. XVII, p. 971 (1907); Ghigi, Mem. Acad. Bologna (6), V., p. 144 (1908); Harington, Jour. B. N. H. S. XIX, p. 309 (1909); Watson, ibid, XXIII, p. 582 (1915); Stuart Baker, ibid, p. 669 (1915); Stevens, ibid, p. 723 (1915).

Vernacular Names.—Mathura (*Chittagong*, *Tipperah*, *Goalpara*), Modura (*Sylhet and Cachar Plains*), Deorik, Dirrik, Durug (*Garo Hills*), Dorik (*Upper Assam*), Deodip (*Cachuri*), Vohtep (*Kuki*), Inruitip (*Naga*), Yit (*Burmese*).

Description.—*Adult Male*.—Whole head, throat, neck and body black with the exception of the feathers of the lower back, rump and upper tail-coverts. Above the plumage is glossed with deep purple blue, the purple dominating in some specimens, whilst in others the lustre is an almost pure deep blue; below, the sheen on the feathers is generally more decidedly purple than it is above.

As the edges of the feathers wear away, the sheen gradually decreases in extent, so that birds in worn abraded plumage appear to be unglossed, dull black above and very brownish below, especially on the abdomen and vent which is never very glossy.

The quills, of which only the innermost secondaries are glossed, are more brown than black, and the lustre on the secondaries is often more distinctly purple than it is on the back.

The lower back, rump and upper tail-coverts are black, subtipped with glossy blue or purple-blue, and with broad terminal bars of white.

The amount of white on these parts varies very greatly in different individuals. In the majority it consists of well-defined broad edges of white from 15" to 25" in depth, but in many the meeting of the black and white is broken up by a narrow strip of black and white vermiculations. In others the feathers are very highly glossed, and have very narrow white edges; in others again these edges are so broad that the black bases are almost concealed, and the rump looks practically pure white. In a few birds the white edges to the feathers of the lower back extend also to the upper back, scapulars and the innermost secondaries and their coverts.

The lower plumage is very seldom marked with white, but I have seen specimens from Goalpara, which marks almost the extreme western range of this pheasant, from Sylhet which is the centre of their habitat, and again from the extreme East (*vide* Oates, *mearsi*) with fine white lines on the feathers of the sides of the breast and flanks, the streaks appearing either as central striae to the feathers or, less often, on the outer webs only. I have also seen one or two specimens with faint indications of white outer edges to the breast feathers.

In young birds the central rectrices are often more or less vermiculated or narrowly barred with brown or brownish white, but this is rare in old birds.

Colours of soft parts.—Bare skin of face and lappels deep crimson, crimson or blood-crimson, brightest in the breeding season, and dullest during the moults; occasionally this portion of the face has a rather brick-red tinge. Iris dark brown, hazel brown, or rarely, red-brown; legs and feet dull greenish plumbeous, plumbeous, ashy-grey, greenish brown or slaty brown. Occasionally a bird may be shot with a pinkish or reddish tinge to the legs, but it is only a slight tinge of this colour, and the legs are never red as they are in the white forms of the Silver Pheasant. Hume describes one bird as having legs of "delicate pale pinkish, drabish brown." The spur is horny brown or black, nearly always darker than the leg itself, but with a white or whitish tip. Bill light greenish or yellowish horny, the culmen darker, the base of the bill usually blackish as far as the nostrils, and sometimes beyond them.

Measurements.—Length about 24", varying according. principally, to the length of the tail; wing from 8·3" (210·8 mm.) to 9·5" (241·3 mm.) and Hume gives the measurements of the wing of one his males as 10·0" (254·0 mm.); the average of fifty birds is almost exactly 9·0" (228·6 mm.); tarsus about 3·2" (81·2 mm.); spur runs up to 1" (25·4 mm.); but is usually rather under this; bill at front about 1·20" (30·5 mm.), and from gape about 1·40" (35·5 mm.). The crest is generally about 3" (76·2 mm.) in a male in good plumage, but I have shot birds with crests of over 3·5" (88·9 mm.).

The weight varies extraordinarily, birds of 4 or 5 years of age greatly exceeding the younger ones. Cocks about a year old will weigh anything between 2½-lbs. and 2¾-lbs. but old birds often exceed 3-lbs. one such shot in November which had been feeding in the just ripened rice fields weighed no less than 3½-lbs.

Adult Female.—Above reddish brown, finely powdered with dark brown, the feathers, except of the head, edged with paler and also with pale shafts; two central pairs of feathers chestnut-brown, more or less vermiculated with dark brown, other tail feathers blackish brown, those next the central pair more or less marked with dull chestnut-brown, but still always shewing in fair contrast to them; upper tail-coverts and rump a little paler than the back. Chin and throat white, grading into brown on the foreneck; remainder of the plumage below brown, generally slightly darker than above, the shafts white and shewing up clearly against the brown webs and the edges of each feather paler than the rest; centre of abdomen paler and dingier brown; under tail-coverts blackish brown narrowly edged paler. Wing-coverts like the back, but generally more broadly edged with a paler tint; quills reddish brown, the innermost secondaries finely vermiculated with dark brown, and sometimes tipped and edged paler.

The variations in colour found in the females consist principally in the depth of colouring on both upper and lower plumage, and in the extent and colour of the pale edges to the feathers. A few birds have the upper plumage a quite dark red-brown, and the under parts are almost blackish-brown with the pale edges and light shafts very conspicuous. Both above and below the amount of pale edging varies very greatly; in some this edging is merely an ashy tint slightly paler than the rest of the feather, in others it becomes a bold sharply-defined border of almost pure white, so broad on the wing-coverts as to form two well-marked bars. There appears to be no geographical distribution governing the variations here referred to, and extremes of all may be met with in one and the same district.

The females of this and the previous species are not easy to distinguish, but on the whole *horsfieldi* is darker than *albocristatus*

and has the central tail feathers a darker chestnut than either *leucomelanus*, or *melanotus*, and has the neck less greyish.

Colours of soft parts.—The colours of the soft parts seem to be much the same as in the male. The iris is usually dark brown, and not red or hazel brown, the red facial skin is somewhat less bright, and also less crimson than in the male, and there are of course no lappels.

Measurements.—Length about 20" to 22"; wing from 8" (203.2 mm.) to 9" (228.6 mm.); tail from 7.5" (190.5 mm.) to 9" (228.6 mm.); tarsus about 2.9" (73.2 mm.); bill at front about 1.1" (27.9 mm.), and from gape about 1.3" (33.0 mm.); the crest varies between 2" (50.8 mm.) and 2.5" (65.5 mm.).

Young Male resembles the female, but is generally much darker in colour both above and below, has the white or buff borders of the feathers in more striking contrast to the rest, and has the rectrices more mottled.

Young males assume a semi-adult plumage at the first autumn moult; the white barred rump is usually attained more or less completely, though the greater part of the rest of the plumage remains brown like the female. Others in addition to the white rump become partially, or rarely, wholly black with a tinge of blue sheen on the upper back, head, scapulars, wing-coverts and upper breast. The wing quills and tail feathers nearly always remain brownish and much mottled.

After the autumn moult is completed, the cocks have usually attained the adult plumage, but even then sometimes have a brownish tinge on the head, neck, and tail-coverts, and it is not rare to find a few white feathers remaining on head, breast or back.

The adult male is brownish rich chestnut with faint central coronal black streaks, a streak from behind the eye very dark rich chestnut, the same under chestnut and buff, median body stripe blackish, sides of body and under parts ash or ashy buff, with blackish streaks on breast, all washed and merging into the sun-brown of the throat.

See also the description of the female on page 185.

The *Arakan* is a very common bird in the forests of the Arakan, and is also found in the forests of the Arakan, and is also found in the forests of the Arakan, and is also found in the forests of the Arakan.

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is also the common pheasant of Manipur, the North-West Chin Hills, in the lower portions wandering down the Chindwin as far as its junction with the Yu River, and down the Irrawaddy at least as far as Katha, or indeed (*vide* Watson in *loc. cit.*) as far as Mojok in the Ruby Mines District.

A specimen in the British Museum is labelled "Manbhum," but I do not think for a moment it was really collected in any district South of the Ganges.

The elimination of *cuvieri* has been rendered necessary, in part owing to the fact that it has latterly been proved that wherever this form is found either *horsfieldi* or *williamsi* is also found, whilst at the same time, the former has been obtained further South and further East than any of the few existing specimens of *cuvieri* have yet been taken. The other reason which has decided me in no longer recognising *cuvieri* as a true form is that there are several specimens similar in every way to this, so-called sub-species, but which shew by their irregular markings that they are merely hybrids. Finally, with further material added to that to which I could refer in 1914, I am convinced that it is quite impossible to lay down any definite area in which *only* *cuvieri* can be found.

Nidification.—The Black-breasted Kalij breeds throughout its area from the level of the Plains up to about 2,000 feet; above this height it is much less common, but a few nests may here and there be taken up to some 3,000 feet, whilst a few odd birds breed up to 4,000 feet and even higher. Thus I once took a nest containing 8 eggs near Hangrum, in the Cachar Hills at about 5,000 feet. Two or three times it has bred below Shillong in the Khasia Hills at about the same height, and again below Kohima in the Naga Hills at much the same elevation. In the Chin Hills, Manipur and Arrakan their eggs have been taken or the young seen at some 3,000 feet or more, but all these nests are merely those of stragglers which have been forced for some reason to breed in places well above their normal breeding points.

Most birds breed in April and May, and, owing to its not breeding over so great a range of elevation, the season is not so prolonged as is that of some of its nearest relations. At the same time I have seen nests and eggs in every month of the year from February to September, and it is quite possible that some pairs have two broods in the year. In North Cachar nests were extremely common between the 15th March and 15th May, and then for a time they were very difficult to obtain, but in July and early August many birds again started laying. The earliest nest I have known was one taken by myself at Dimagi in North Lakhimpur on the 24th February in a small patch of scrub jungle close to a huge bheel over which we were duck shooting. Shortly after the shot fired at some duck, the two birds, which were probably

drinking at the edge of the water, got up with their usual flurry and fluster, and I knocked over the hen, which fell into the adjacent jungle. Going into this to fetch her out, one of the boatmen stumbled on to her nest which contained five fresh eggs.

The nest is nearly always placed in forest and the class of forest most often chosen is the damp evergreen forest met with everywhere along the foot hills and broken ground bordering the higher ranges of the Himalayas. Inside these might forests, composed of an endless variety of trees, mostly tall and mostly covered with a luxuriant motley of parasites of all kinds, but also with a plentiful undergrowth of canes, brambles and other plants, the Black-breasted Kalij has its favourite haunts. Occasionally in their inner depths one may come across tiny green glades in the general dense undergrowth. Here the vivid green moss seems even more green than elsewhere, forming a springy carpet; ferns grow here and there over its surface, and the sun only comes to it in dappled, quivering patches through the branches high overhead. Such spots are much beloved by the Kalij Pheasant, and many a time have I come across its nest in the bushes immediately surrounding them. Comparatively open spots of this description attract numerous insects, and I am afraid it is these rather than their special natural beauty which induces the pheasants to commence their domestic duties within easy reach of them. The nest itself is more often than not placed in some tangle of bushes, briars or canes at the foot of one of the bigger trees, well-concealed from inquisitive eyes, and in some position less moist than its surroundings. Sometimes, with mossy, fern-covered sides are often to be seen in these places a rock or boulder may form its principal support, but as a work of art the nest is a failure; a heap of leaves and rubbish scratched into a heap with a rough depression in the middle for the eggs in the limit attained, and Mother Nature herself is responsible for all the collecting that has been done in the businesses of the cotton-tree (*Bombax malabarica*), which sends its aerial roots from the main trunk, fern recesses into the ground, and in every quarter blow their quota of fallen leaves and twigs, and thus become splendid places in which to lay an egg; and many a nest have I seen both of the Kalij and other game-birds in these cosy corners. The Kalij is not growing actually in water or in mud, but in the home for a brood of chicks, and in the bamboo jungle. Such sites are common in Bengal, and not common in the Himalayas, specially when growing in bamboo, and the secondary forest, and the native hunter, seems to

Wherever the nest may be, two things seem to be essential, the very close vicinity of water and open ground not too distant for feeding. The open ground may be anything from a mere forest road to extensive cultivation, or a natural open expanse, and in the same way the water may be the river Brahmapootra itself, a lake or swamp, or it may be the mere lazy trickle of some tiny stream which wends its way from rock to rock down a hill ravine in the hot weather.

The number of eggs laid is perhaps most often 7 to 9, but very often only 5 or 6 are laid, and sometimes only 4; on the other hand this pheasant sometimes lays as many as 10, though this is probably the maximum.

In colour the eggs vary almost as much as those of the many varieties of Barn-door Fowl. I have in my collection one clutch absolutely pure white, and another a most beautiful deep pink café-au-lait, a richer, deeper colour than I have ever seen in a domestic fowl's eggs. Between these two extremes every variation may be found, but the colour of 9 eggs out of 10 is a pale buff or cream, some slightly darker, some slightly paler.

Typically the surface is quite smooth, and in some eggs there is even a slight gloss; the texture is close and hard, but though the shell is stout and strong, it is *not* coarse, but rather fine. Occasionally one comes across a clutch coarse and pitted on the surface, similar to those described by Hume, but these are the exception and not the rule. In the same way I should not say that the "usual hen's egg shape" of those described by Hume represented the average Black-breasted Pheasant's egg, though it would do for many of them. On an average their eggs are rather longer in proportion than jungle-fowl's eggs, have a nearer approach to direct reduction of size at the smaller end, and are on the whole more elegantly shaped eggs than those of that bird.

The white speckling found in some instances on most unicoloured game-birds' eggs are also to be found in these, but this is a rare occurrence, and is not often met with, as it is in the Polyplectrons and some other eggs.

In size the eggs vary in length from 1.65" (39.9 mm.) to 2.1" (53.3 mm.), and the average of 100 eggs is 1.92" (48.7 mm.), and in breadth between 1.32" (33.5 mm.) and 1.53" (38.8 mm.), the average being 1.46" (37.1 mm.).

Incubation seems to take 20 to 22 days in the case of all Kalij Pheasants and Jungle-Fowl, generally 20 days in the warmer, mountain parts of their habitat, and up to 22 at higher, cooler elevations.

I do not think the Black-breasted Kalij is polygamous, for I have more than once come across both parents looking after their young, and moreover, the male is generally to be found near the nest when the hen bird is sitting.

more fully plumaged cocks may sometimes be found in company with several other birds in hen plumage, but these are, I believe, merely their wives and their young ones, the latter, of course, all in female plumage or in plumage which at a little distance looks like that of the female.

A very interesting little note by Mr. H. W. A. Watson in a recent number of the Journal confirms this idea that the cocks are monogamous. He writes:—

“I came across a cock Kalij Pheasant (*G. horsfieldi*) looking after a flock of young a few days old. I saw no signs of the hen, though I watched the cock for several minutes. Probably she was absent looking for food. The cock was very aggressive, and ran round demonstrating, often coming within ten feet of me. The chicks were hiding in the leaves, one within a few inches of my foot.”

According to Cripps, the hen is an extraordinarily close sitter; on one occasion he caught a female on her nest of 4 fresh eggs, and on a second occasion a hen bird sat tight on her nest whilst men were felling jungle all round her, and refused to move until the axe was laid to the tree at the root of which her nest was.

This has not been my experience, though I have seen some hundreds of nests. The hen bird nearly always sneaks quietly off before one can catch a glimpse of her; it is only when caught suddenly on the nest and unable to move without attracting attention that she will flatten herself out, almost close her eyes and try to escape notice. Even then, directly she discovers she has been seen, and before one is within grabbing distance of her, she bolts off, and on one such occasion I saw her scatter some of her eggs in all directions as she flew headlong from her nest of dead leaves and grasses.

Habits.—The Black-breasted Kalij Pheasant is a bird normally of the humid, hot climate between the Plains and some 1,500 feet elevation; in fact, just the sort of climate we should expect a black bird of this description to live in. Of course, it wanders more or less out into the plains for some fifty miles or so, and again may be found as high as 6,000 feet up in the Himalayas both North and South of the Brahmapootra. But, though the Plains' birds may be indeed often are permanent residents therein, those of the higher hills are only stragglers. I doubt if any birds permanently remain much above 3,000 feet, and only then where there are hot, sweltering valleys with dense moist forest.

In the Khasia Hills we used occasionally to find them breeding about Dumptop and the forests below the Shillong Cherrapoongi road, somewhere about 4,000 feet elevation. The birds reared here were exceptionally small and poor, and I thought at first that the Khasia Hills were inhabited by a small race of *Gomacus*

horsfieldi. When, however, I tried to get a series together to prove or disprove this theory, it was impossible to get any but a rare straggler away from the foot hills where under 1,000 feet they were most plentiful.

Above in describing their favourite nesting haunts I have also described the kind of place in which the birds are most often to be found throughout the year. At times, especially when the bamboo jungles are seeding, they haunt this kind of cover in company with many other seed-eating birds. They also are very fond of small patches of bushes, scrub and dense secondary growth in the vicinity of villages, but they seldom are to be found in these unless there is heavy forest within easy reach.

During the early mornings and evenings they frequent forest roads and jungle paths, the edges of cultivation and the open banks of rivers and streams. Here they wander about singly, in pairs or in small flocks and family parties, often in company with jungle-fowl, with whom they consort on quite amiable terms at any other but the breeding season.

As soon as the sun is an hour or two above the horizon they gradually make their way into the forest, but continue to peck and scratch about for food until nearly midday, when they fly up into some tree to roost, generally selecting a broad limb within a few feet of the ground. They remain here until the shadows begin to lengthen, and then again descending, leisurely feed their way out once more into the open, where they stay until sunset, immediately after which they retire for the night, and are all settled on their perches long before it is dark.

They are very quiet birds as they move about in the forest, and are much less energetic and quick in their movements than are Jungle-Fowl. When they scratch and turn over the leaves in their search for grubs and fallen fruit, they do so in a very slow methodical way, and one never sees the wild scattering of leaves and misplaced fluster so often indulged in by the Jungle-Fowl of both sexes. So too they do not get stampeded by non-existent foes and rush off shrieking and cackling, only to find after a few minutes that there was no need to move at all. They go their way quietly and sedately, uttering as they move about a low *kurr-kurr-kurrchi-kurr* as if to let the other members of their family know where they are, for the flocks scatter a good deal when in heavy cover, until they come to the edge of the cultivation where they intend to feed. Here there is usually a halt, as each individual satisfies himself or herself there is no danger, and then out they come and commence the serious morning and evening business of getting full. Once out in the open they seem to keep closer together than in the forest, evidently relying to some extent on each other for the necessary warning in case of alarm.

They are shy birds, but yet neither so shy nor so wary as Jungle-Fowl, and when the two are together it is almost invariably the Jungle-Fowl who first takes alarm and sneak off into safety. Their manner too of leaving is very different. A cock Jungle-Fowl disturbed takes but a second to make up his mind, a rapid glance in the direction of the intruder, and down go head and tail, and with hasty but stealthy steps he is off out of sight. The Pheasant is not nearly so prompt in his actions, and if one disturbs a party of these birds and keeps absolutely still, quite an amusing little comedy may be seen before they make up their minds that discretion is the better part of valour. When standing in the deep shade of a tree I have seen from a distance of some 40 or 50 yards a party of Kalij Pheasants take minutes to decide if I was dangerous or not. An unlucky twig stepped on as I crept along just inside the jungle had attracted their attention, but the light was bad, and the food on which they were engaged,—termites—plentiful and engrossing. At the snap of the twig every bird stopped and looked at me, for the first instant motionless, and then, screwing and twisting their necks about in an endeavour to get a better view. After a few seconds a fat white ant tumbling down in front of one bird was more than she could resist, and a hasty snatch and gulp put it safely away. No harm coming to her from this, she was very shortly busily re-engaged in chasing and gobbling up the termites as they crept from their holes or fell down again after their flight. Her example was enough for the others, and within five minutes they were all happily engaged as unsuspecting as if no danger was anywhere near them.

It was so amusing to watch them, that I cautiously stepped back into still darker shadow without frightening them. A patch of ground on which hill-rice had been grown and cut had left as stubble some 4 to 6 inches high, and amongst this the Pheasants, 8 in number, scurried to and fro, darting at ant after ant, often fluttering up a few feet in the air as if in ungainly emulation of the kingcrows, jays, and other birds which constantly swept backwards and forwards in graceful pursuit of those insects which had winged their way higher up.

Ten minutes of this, however, satisfied my curiosity, and as I was in camp, and had to shoot for the pot, I then stepped out, bowled over the cock as he ran helter skelter for the bushes, and his wife, as she winged her way over his fallen body.

The Kalij nowhere collects in such numbers as to afford a day's sport like the Jungle-Fowl does yet there are many places where with a few beaters one may get quite enough shots to make a very interesting morning or evening's walk, and probably with dogs—personally I have never shot with trained ones—the result might be even better.

As far as I remember six brace of Kalij Pheasant is the biggest bag I have ever made of these birds and this was made over practically the same ground as that which is described in the article on Jungle-Fowl shooting in the last number of the Journal.

As a rule, when shooting along these mustard fields bordering the Kopili River one got two or three Jungle-Fowl to one Pheasant, but this time the reverse was the case.

My companions (on the occasion of which I write) consisted of a Mikir tracker, and a second Mikir with my rifle, and an odd man to work as beater, jungle cutter, luncheon carrier, &c. This was quite enough for all the beating we should require, for the strips were mostly narrow bits along the banks, shut in on one side by very heavy evergreen forest, and on the other by the shingly banks of the stream. Starting just after daybreak, our first "*jhum*," or open bit of cultivation, was occupied only by some Jungle-Fowl who were the first to detect our meeting, and gave no chance of a shot, but as we passed through the next bit of forest, a hasty but lucky shot right and left brought down two fat Bronzed-backed Imperial Pigeon, and some quarter of a mile further on we came to a second mustard field. In this we could see some birds feeding about half-way down, though we could not make out exactly what they were in the tall mustard. Leaving my men under cover, I went forward inside the jungle about 20 yards, and when I judged I had gone far enough, notified them with a low whistle to come on. Sneaking along just inside the fringes of forest I kept about the same distance, or a little more ahead of the men, and when frightened by the latter, the pheasant got up, had an easy right and left, adding two more birds to the bag. My next shot was at a hen Jungle-Fowl, as she scurried through the mustard into shelter, just giving me a momentary glance as she left the former. Picking her up, we then went on through a patch of semi-burnt cane and grass, missing an old cock Jungle-Fowl as he got up with a cackle and tremendous flurry on the far side of some charred canes.

Two more long snap-shots at running birds are tinkered, and then I have a bit of luck, for we step out of the jungle into a mustard field, right into a family party of Kalij, who are scratching round for food just outside the forest. Quite overcome by the suddenness of our appearance, the birds, 6 in number, take at once to flight, scattering in all directions, but two drop to my shots, and two others who have gone towards the stream are turned back by the sight of some men fishing, and wheel round to their original cover, giving me splendid high overhead shots, and both coming down tremendous thumps in response thereto. One of these, however, is a runner, and for some time evades my men in their efforts to catch her, until at last a luckily flung stick bowls her over as she dodges from one bush to another.

So we wander on, now through a bit of virgin forest, now through a mustard field, and then through a piece of burnt grass, the black surface shewing the pugs of a tiger who has passed by some two or three hours earlier. We follow them to the stream where the tiger has had his drink, and then return to the forest in which we soon lose all trace of him.

Changing my rifle once more for the smooth bore and leaving stripes to rest in comfort, we turned and worked down the opposite side of the stream towards camp. The first birds we put up are some Jungle-Fowl who have been drinking before retiring into the forest for their midday siesta; as they fly past us I knock the tail feathers out of the cock bird leading them, with a real ~~bad~~ shot, and bring down a second with a straighter one. The tailless cock and the others have gone down in the jungle just ahead of us, so spreading out, we walk them out toward the next *ghum* every now and then hearing them as they hurry forward, rustling over the fallen leaves. Before we get to the edge of the jungle, they have cleared off without giving another chance, but a single cock Kalij which has tarried a little longer than the others gets up just as we too emerge from the trees, and is promptly bowled over and gathered. The mustard here is so high, up to our waists, that we may find some birds lying up in it, and accordingly we work through it in line, myself on the inside next the forest, and a few yards ahead of the men. Within the next few minutes two birds run through the mustard and gain the jungle in front of me without giving a chance, and then a barking deer jumps up and comes bounding past me about 40 yards off, barking as he starts, and barking again as he gains cover and stands, inside defying me. He is still barking as we pass where he stands and I can hear the stamp of his forefeet before panic again seizes him, and he dashes away further into the depth of the forest. Nothing more shews up until I have reached the end of the mustard, and stand on the yard or two of bare ground which separates it from the nearest trees. As the men come nearer, two or three Jungle-Fowl flit across it, and then there is a tremendous commotion as nearly a dozen birds, Jungle-Fowl and Pheasants mixed together rise into the air. A hasty shot at one of the former, not only knocks it over, but also accounts for an unlucky hen pheasant which has come into the line of fire, and a second shot brings to bag another hen pheasant which falls, a cloud of flying feathers, with a bang right on to the man with my luncheon basket. After he has righted himself and collected my scattered provisions, we proceed on our way, and by noon, when we stop to have a rest and lunch, I have managed to bag twelve Pheasants, six Jungle-Fowl, three Imperial Pigeon, and a couple of very evil-smelling White-eyed Pochard, which, however, are not disdained by the coolies.

Kalij Pheasant are not nearly such noisy birds as are Jungle-Fowl, but call—one can hardly call it crowing—pretty regularly during the breeding season. This call or crow seems to be uttered only during the mornings and evenings, and never in the middle of the day, as is that of the Jungle Cock. A Cock Kalij only calls on his roosting perch before he gets down from it in the morning, and after he has returned to it in the evening before settling down for the night. Nor does he use his crow as a challenge to other cocks; when he wants a fight, or pretends that he wants a fight, he proclaims the fact by loud flappings of his wings, and by quickly repeated beatings together of the tail above his back, and also by beating them on his ribs. In the former case the sound made is very loud and sharp, only lasting a second or two, but when a male bird drums against his side the noise is much lower and softer, and is continued for some seconds or even minutes.

At the same time the Kalij is not in the same class as the Jungle Fowl as a fighter in any way, far slower and less decisive in his movements, he has not the same real delight in a scrap as has that bird. I have often heard Kalij Cocks defying one another to mortal combat when seated at a few yards apart, but the finale has nearly always been disappointing. If one bird really makes up his mind to fight, the other has as a rule already made up his mind that he does not want to. Sometimes they will actually meet, and after much mutual abuse and wary walking round, both birds simultaneously decide that there is really nothing to fight about, and retire to their own domains, or commence feeding.

Now and then in the height of the breeding season the fights develop in to really fierce battles, and are continued until one or the other of the combatants owns himself beaten and sneaks away, often in a very tattered and featherless condition about head and neck.

I have already described a fight which I witnessed between a cock Jungle-Fowl and a Kalij Pheasant, but in this case the former was the aggressor and the latter would have retired after a very few rounds had he been able to escape.

A similar fight, though on this occasion the *casus belli* was in possession of an ant-hill from which termites were issuing, was witnessed by Mr. R. A. Clark in Cachar. In this instance also the fight ended in the running of the Kalij. After a description of this fight, Mr. Clark writes:—

“On another occasion I came across a pair of male Kalij fighting amongst a lot of fern; they were so taken up with their own affairs that they did not notice my having approached to within fifteen yards; I let them go on for ten minutes, and then went up and caught both; they were quite exhausted, the feathers from the head and neck had all been knocked off, and the latter were bleeding in both birds.”

Like the rest of the family in India, these Pheasants prefer to use their legs to their wings to avoid pursuit, and will always run rather than fly as long as there is any cover to conceal them, and no obnoxious dog to put them up. Unless they are actually forced to the very edge of a jungle by beaters or one comes on them in the open so suddenly that they lose their heads, it is most difficult to make them rise, and when shooting, more especially when shooting for the pot, it is frequently necessary to shoot them as they run, perhaps no easier a feat than when they are on the wing, for they make use of every scrap of cover, and only give the snappiest of snap-shots as they dodge from one bush to another.

On the wing they are fair fliers once they get away, though they appear to be going much slower than is really the case. On the flat they simply fly from one forest to another, but when shooting in hills the sportsmen will find they nearly always run *up* hill and fly *down* hill, consequently after the first mad rush into the air they sail down at a tremendous pace, and one must keep well forward to obtain clean shots. They do not stand, comparatively, as much knocking about as do Jungle-Fowl, though they are bigger and heavier birds; they have not as much heart, and their feathers seem to be less impervious to shot than those of that bird.

They are very omnivorous in their diet and will eat practically anything from bamboo seeds to small snakes and lizards. Their favourite articles of food are the same as those of all other game-birds, with whose habits I am intimately acquainted, *i.e.*, white ants, fruit of the various *fici* and bamboo seed. To this must be added, in the case of the Kalij, forest yams and the roots of small ginger-like plants very common over a great portion of their habitat.

Birds which have been feeding on this extremely acrid, pungent root are almost uneatable, otherwise they are normally very good eating, though naturally old birds are tough unless eaten whilst still warm or hung for several days. Probably the best way of eating these birds is in the old gipsy manner, rolling them up in a mass of clay, feathers and all, chucking them into a heap of red-hot ashes until the clay is baked hard, after which the clay may be broken, when the feathers come away with it, and the dish is ready.

Like the Jungle-Fowl, the Kalij Pheasant is difficult to domesticate, but by no means impossible, and given a big enough aviary and lots of brushwood or other cover under which to hide, they soon become more or less tame. It would probably be impossible to tame them sufficiently to run loose with domestic fowls, for though chicks may be hatched from eggs put under hens and reared without much trouble, they always clear off directly the breeding season approaches.

Cripps says that they are quite impossible to tame, and that he has seen many in Sylhet as wild to the last as the day they were

caught. It must be remembered, however, that the Sylhetees and other people of the Assam Valley who trap these birds in great numbers keep them in tiny cages, and make no real attempt to domesticate or tame them. As a matter of fact these people actually sew the poor birds' eyelids together as soon as they are caught, in order to prevent them knocking themselves to pieces in the cages. When thus blinded, the birds crouch in one corner and refuse to move, and even if released from the cage, make no attempt to escape. I have sometimes bought some of these birds in order to release them from this cruelty, but I must say that they seem to suffer less from the eyelids being fastened than from the self-inflicted injuries once the eyelids were freed of the stitches. The Hill-Tribes catch these pheasants in many ways. The small brushwood fence with well-noosed little gaps at intervals has often been described as that used for other birds; another plan is to noose the sides of a path on which grain has been thrown, and yet another means employed with success is to peg down a decoy bird, surround it on all sides with nooses and then secure any bird which comes either to fight with or examine the decoy. I should mention that I have never known a decoy bird either drum, crow, or in any other way *challenge* his wild rivals to a fight, at the same time his fluttering attempts to regain his freedom accompanied by indignant squawks and squeaks as the string checks his efforts seem equally effective in attracting notice.

GENNAEUS HORSFIELDI WILLIAMS.

Williams' Kali Pheasant.

Gennaeus williamsi, Oates, Man. Game-B. 1., p. 342 (1898); id, Ibis. 1903, p. 104; id. Jour. B.N.H.S. XVI., p. 86 (1907); Ghigi, Mem. Acad. Bologna (6), v., p. 142 (1908).

Gennaeus turneri, Finn., Jour. Asiat. Soc. Beng. XIX., pt. 2, p. 146 (1901.)

Gennaeus macdonaldi, Oates, Jour. B.N.H.S. XVII., p. 10 (1906); Ghigi, Mem. Acad. Bologna, (6), v., p. 142 (1908).

Gennaeus ommaneyi, Oates? Type in B.M.

Vernacular Names.—Yit (*Burmese*), Rak (*Arrakan*).

Description.—*Adult Male*.—Crest black; head, neck, back and wing-coverts grey, this effect in colour being formed by numerous tiny bars of white or buffy white on a black ground; feathers of lower back, rump and upper tail-coverts black, crossed with several narrow bars of white, and with broad white edges, these edges being sufficiently bold to make these portions of the plumage contrast strongly with the tail and upper back. Tail like the back, but more boldly marked with bars rather than with vermiculations.

Visible portions of the wing quills like their coverts, inner webs of primaries brown, obsoletely mottled with darker brown, whole lower plumage black, like all other sub-species inhabiting a range of country between two species, this form varies considerably on the

outer limits of its habitat. The variation consists principally in the boldness of the markings which make up between them the grey of the upper parts; in some specimens the markings are so minute that they can only be called vermiculations, though these seem to always run in regular bars, in others the markings are bolder and form distinct bars of white on a black ground. These latter individuals become more and more common as we approach the limits of *rufipes*, whilst the former characters predominate as we draw nearer the country occupied by *oatesi*. In this part of the southern region covered by *williamsi*, it is also noticeable that the rump and upper back grade into one another through the lower back instead of the upper back being sharply defined from the other two. Such specimens are, however, comparatively rare, and even in these the rump and upper tail-coverts are quite boldly barred with white in comparison with the rest of the plumage.

Colours of the soft parts.—Iris brown, light brown or golden brown; lappets and facial skin deep crimson red or crimson, duller in the autumn and winter; legs various shades of dark and light plumbeous-brown, ashy-brown, or fleshy livid, never red; the spur is a dark horny brown with a paler tip.

Measurements.—Wing from 8·6" (218·4 mm.) to 10" (254·0 mm.); average of forty birds, 8·91" (226·3 mm.); tail from 8·6" (218·4 mm.) to 12" (304·8 mm.); average of forty birds, 10·15" (258·8 mm.); tarsus about 3" (76·2 mm.), with a spur up to 1" (25·4 mm.); but generally about 7" (17·8 mm.); bill at front 1·2" (30·4 mm.), and from gape 1·4" (35·6 mm.).

The crest runs up to about 3" (76·2 mm.), but is generally about 2·5" (69·5 mm.).

Adult Female.—Very similar to true *horsfieldi*, but can always be distinguished by the tail feathers. In this sub-species the central or two central pairs are much the same as in the other sub-species, though they are generally paler and still more chestnut in colour, the outer feathers are, however, black or nearly black with numerous narrow and irregular broken bars of white. On the whole the females of *G. h. williamsi* are paler and more chestnut on the upper plumage, but this does not always hold good, and over every portion of its area, specimens of *williamsi* may be met with quite as dark as the darkest of *G. h. horsfieldi*.

The females of this sub-species appear to be remarkably constant, for though the British Museum has an excellent series, little variation can be found in it. A few birds are decidedly paler than others, and have the general tone more a buff than a chestnut. The under surface of the tail varies from an almost unmarked blackish brown to a well-barred surface similar to the upper aspect.

Colours of the soft parts.—Similar to those of *horsfieldi*. It should be noted particularly that the legs of this sub-species, both

male and female, are those of true *horsfieldi*, and shew no signs of grading into the red legs of *rufipes* and the *nycthemerus* group.

Measurements.—Wing from 7·7" (195·6 mm.) to 9·1" (231·1 mm.) average of thirty birds, 8·35" (212·1 mm.); tail from 7·2" (183·9 mm.) to 8·8" (223·5 mm.); average of thirty birds, 8·06" (204·7); tarsus about 2·75" (69·8 mm.); bill at front about 1·1" (27·9 mm.), and from gape a little over 1·3" (33·0 mm.).

Young Male.—A specimen in the Oates' Collection which is labelled "♂, see spurs" is identically like an adult female. In spite of the spurs, on account of which this specimen has been sexed ♂, I should not be surprised if it turned out to be an old barren female. One would expect young adult males carrying spurs like this to be in male plumage, and we should also expect the young males to follow the same rules as *horsfieldi* and be considerably darker and more boldly marked below than the females.

Distribution.—Williams' Silver Pheasant has a very well defined range, being practically confined to the moderately high hills lying between the Manipur, Yaw, Oyu and Irrawaddy Rivers, and in the Arrakan Yomas on the East, and the hilly country East again of the main ridge as far South as Minbu on the Irrawaddy and further West as far as latitude 19·5, or about level with Thayetmyo. North it occurs as far as Homalin and Tammu, whence I have seen typical specimens. In Arrakan, South of Pakkoku, it appears to be rare, and over much of the low-lying dry zone, no Silver Pheasants are to be found. To the West it is found on all the higher ground on the East of the Manipur River, typical specimens having been obtained from Fort White, Tiddim, Falam, &c.

On the rivers themselves and at levels below 1,000 feet true *horsfieldi* penetrates far into the areas, the higher parts of which are occupied by *williamsi*, and the consequence is that on the intervening line we are constantly meeting with birds which cannot be ascribed to either sub-species, and again other birds which appear to be the result of interbreeding between *horsfieldi* and *rufipes* or even *horsfieldi* and *nycthemerus*.

In the Southern low-lying portion of the inter Chindwin-Mu and Mu-Irrawaddy regions there appear to be no Pheasants except for a rare straggler of true *horsfieldi* which may now and then be met with in the forests bordering the rivers.

Nidification.—So far there is nothing on record as regards the nidification of this sub-species, though its nests and eggs have been taken by Messrs. P. Wickham, J. M. D. Mackenzie and C. Hopwood, and also, I believe, Mr. P. MacDonald.

Nests with eggs have so far apparently only been taken in April and May, but there is little doubt that though these two months are probably those in which most eggs are laid, they will also be found in March and June, and probably other months as well.

Judging from what my correspondents write, their nests appear to be the same as those of the rest of the family, a mere heap of leaves in bush jungle or forest, or, sometimes, in bamboo jungle. The number of eggs laid is probably about 6 to 8, sometimes less, but seldom more, and they are similar to those of *horsfieldi*, but would appear to average smaller. Eggs I owe to Messrs. Hopwood, Wickham and Mackenzie, range in length from 43·6 mm. to 47·7 mm. and in breadth from 33·6 mm. to 36·8 mm., whilst they average 45·5 mm. by 35·8 mm. The few I have seen have all been of a pale buff or cream colour, but doubtless they vary in depth of tint much as do all Kalij Pheasants' eggs.

Habits.—Williams' Kalij Pheasant seems to be a bird of moderate levels, never descending to the Plains except as a casual wanderer down to the smallest trees, and seldom being found above 4,000 feet, though in some isolated peaks, such as Mount Victoria, it has been shot as high up as 6,000 feet.

There is practically nothing on record as to its habits, but what little there is shews it to be the same shy, skulking bird as the rest of the genus, using its feet always in preference to its wings, and almost impossible to flush without the use of dogs.

Its plumage of grey makes it quite as difficult to see in the semi-shadow land of the places it haunts, as is the more sombre black plumage of the Black-breasted Kalij in the deeper shadows of the ever green forests found in the wetter valleys below. Col. Harington informed me that he had never come across this pheasant in the hot dry zone in the South of the tract between the Irrawaddy and the other rivers on the West. He also told me that he believed it to be a very rare bird throughout the Pakkoku District, which was too hot, too low and too dry for it, and probably it would not occur, except accidentally, away from the hill ranges which run down from the Central Arrakan Yomas. It was, he said, essentially a bird of the forest or mixed forest and bamboos, and did not haunt the higher grass-covered plateaus which are often frequented by the birds of the *nycthemerus* group.

(To be continued.)

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY

No. XVI.

(A)—THE TUPALAS OF SOUTH TENASSERIM.

BY OLDFIELD THOMAS.

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A nice series of Tree Shrews from Pegu, topotypes of *Tupaia belangeri*, presented by Mr. J. M. D. Mackenzie, has enabled me to investigate afresh the relationship of the southern members of the *T. belangeri* group to the northern members of the *ferruginea* group.

When Dr. Lyon wrote his Monograph of the Tupaiidæ in 1913 the only modern examples of typical *belangeri* were two collected near Rangoon by Major Harington, and these differ materially in their degree of rufous on the posterior back, the one almost without it, the other strongly rufous.

Having to choose one of these as the more typical, Dr. Lyon chose the rufous one, but Mr. Mackenzie's series now shows that the normal coloration in this region is as in the other specimen, without rufous on the rump.

Further east in the Moulmein region, and southwards as far as Tenasserim town, similar forms occur, but becoming more and more frequently rufous or ochraceous posteriorly.

All these animals have a short snout to the skull, and have three pairs of mammae, evenly spaced on the axillo-inguinal area.

In the extreme south of Tenasserim, however, at Bankachon (spelt by Davison Bankasun) the local form is much brighter and more markedly red-rumped, and this seemed at first to indicate a local sub-species of *belangeri*. Specimens of it collected by Davison have long been known, and always considered as *belangeri*.

But close examination shows the remarkable fact that while these specimens have the general appearance, and (with the variation indicated below) the mammary formula of *belangeri*, they have the longer skull of the North Malay representative of the *ferruginea* group, *T. lacernata wilkinsoni*, whose type locality is Trang, about 180 miles south of Bankachon.

This skull difference—and there is no other—seems slight when isolated specimens are examined, but is so constant and with such a complete absence of intermediate specimens that there seems no doubt that the *Tupaia* of extreme S. Tenasserim is a distinct species intercalated between *belangeri* to the north and *lacernata* to the south.

It may be briefly described as follows:—

Tupaia clarissa, sp. n.

Colour essentially as in *T. belangeri* but brighter and clearer, and the rump more definitely ochraceous, contrasting with the clear olive grey of the fore-back and head. Mammæ in three females 4, 5 and 6, their positions, when 6, as in *belangeri*, and, when less than 6, such as to indicate that it is the normal posterior pair which is absent, the spacing being quite different from that found in the four-mammied *lacernata*.

Skull with the narrow elongated muzzle of *lacernata*, its length, measured from the gnathion to the concavity on the front edge of the orbit above the lachrymal projection, 24, 24, 24.1, 24.4, 24.6, 24.6, 25.2 in seven specimens, as contrasted with 22.0, 22.1, 22.3, 22.3, 22.4, 22.6, and 23.3 in an equal number of *T. belangeri* from the region of Tenasserim town.

Dimensions of the type, measured in the flesh:—

Head and Body:—182mm.; tail 171; hindfoot 43; ear 17.

Skull:—Greatest length 52.5; condylo-basal length 49.5; length of muzzle 25.2; upper tooth row 28.5.

Hab:—Bankachon, Victoria Province, S. Tenasserim.

Type.—Adult male. B. M. No. 14.12.8.95. Original number 4395. Collected 5th December 1913 by G. C. Shortridge. Presented to the National Museum by the Bombay Natural History Society.

T. clarissa cannot have a very wide distribution, as it is replaced by *T. belangeri* 120 miles north at Tenasserim town, and by *T. willinsoni* 180 miles south at Trang. It probably ranges along the hills which extend for about a hundred miles south of its type locality Bankachon.

These very clear-coloured red-rumped specimens being completely removed as a separate species, we may further consider whether the southern form of *belangeri*, as best represented by the Tenasserim series, can still be looked upon as quite the same as the typical race of that species as found in Pegu.

Of the available specimens from Pegu, now 10 in number, only one, No. 6.4.5.3, referred to by Dr. Lyon, has a rufous hind back, and this may possibly be due to bleaching. And the type in Paris, as recorded by Dr. Lyon, is also without rufous. On the other hand, of seven examples from Tenasserim town and its neighbourhood all but one have a well marked rufous or ochraceous rump, and this is also the case with most Mergui specimens and a considerable proportion of those from Northern Tenasserim up to the mouth of the Salween.

Consequently we might well recognize the average difference in colour between the extremes by making a local subspecies of the

form from Tenasserim town and its neighbourhood, and looking upon the Moulmein and other North Tenasserim specimens as intermediates.

Tupaia belangeri tenaster, subsp. n.

Colour as in true *belangeri*, but the rump more or less ochraceous. Mammæ 6. Proportions of snout as in *belangeri*, not as in *clarissa*.

Dimensions of the type—

Hind foot :—40·5.

Skull :—Greatest length 50 ; condylo-basal length 46·8 ; length of snout 22·3 ; upper tooth series 26.

Hab. :—Of type, Tagoot, Great Tenasserim River ; other specimens from Tenasserim town.

Type.—Adult male. B. M. No. 17.3.25.3. Original number 5153. Collected 18th April 1914 by G. C. Shortridge. Presented to the National Museum by the Bombay Natural History Society.

(B)—NOTES ON MILLARDIA AND ITS ALLIES.

BY OLDFIELD THOMAS.

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In attempting to determine a *Mettad* sent to the British Museum by Col. H. N. Dunn from Ambala, I have examined all the available specimens of the group, quite a considerable number, and mostly part of the Indian Mammal Survey material.

With regard to the relations of the very distinct Burma species, *Millardia kathleenæ*, to the typical Indian *Mettads*, with which I doubtfully associated it, I now find that like as its skull is to that of a true *Millardia*, the structure of its teeth is not the same, so that in conjunction with its mammary formula, it may well be distinguished generically.

Remembering its discovery by Mr. Guy C. Shortridge, who believed, and as it now proves rightly, that he had found a new genus, I would propose for it the name of

GUYIA, g. n.

General characters, number of foot-pads and structure of skull as in *Millardia*, but the mammæ 0-2=4 instead of 2-2=8, and the molar pattern different.

Genotype *Guyia kathleenæ* (*Millardia kathleenæ*, Thos.).

Range :—Dry zone of Burma. As yet only known from Mt. Popa and Pyawbwe.

The most marked characteristic of the molars of *Millardia* is their considerable breadth as compared with their length, and the

subequal and very distinct development of each of their cusps, so as to give them a superficial resemblance to those of *Gobunda*. On the other hand in *Guyia* the teeth are not broader than those of normal Murines, and the peculiar look of those of *Millardia* is quite removed by this fact and also by the almost complete obsolescence of the outer cusp of the first lamina of m^1 (t 3 of Miller's notation *), and the reduction, relative and absolute, of the corresponding cusp in the second molar. The last lamina of m^3 also consists of only one instead of two cusps, but enough young specimens are not available to determine how far this difference is constant.

Passing to true *Millardia*, we find that there is so wide a range of variation, in series from single localities, in general size, size of skull, and especially in the size of the teeth, that it seems impossible to sort them into species by these characters, and we are reduced to distinguish them by colour only.

Judged by this alone there seem to be four recognisable forms of the genus, two of a normal greyish colour, respectively lighter and darker, and two of a pallid or desert colour. All four, in the absence of more essential characters, I should only consider as local subspecies.

1. *Millardia meltada meltada*, Gray, from the following regions, viz.:—Dharwar, Ahmednagar, Hoshangabad, Hazaribagh†, Coorg and Ceylon. Greyish mouse colour, commonly bleaching to brown.

2. *Millardia m. listoni*, Wr., from the Konkan and Nasik; darker grey.

3. *Millardia m. pallidior*, Ryley., Gujerath, Kathiawar, Cutch and Sind; pallid grey.

And finally the following new form:—

4. *Millardia meltada dunni*, subsp. n.

Size of type small. General colour above pale whitish buffy, lined with the dark brown tips of the longer hairs, the light rings pale buffy. Flanks clear light buffy. Undersurface white with scarcely a tinge of buffy, the basal two-thirds of the hair slaty as usual. Ears pale brown. Hands and feet white, tail rather short, well haired, dark brown above, white on sides and below.

Skull with the supraorbital crests not heavy, though the specimen is old. Palatal foramina to the level of the anterior inner root of m^1 .

Dimensions of the type.—Head and body 114 mm; tail 94; hindfoot 22.5; ear 21.

Skull.—Greatest length 31.5; condylo-incisive length 30.5; zygomatic breadth 15; nasals 12.7; palatal foramina 7.5; upper molar series 5.

* Mamm. W. Europe, p. 301, 1912.

† But with regard to this locality, by far the most eastward of all, see below under *Diomys crumpi*.

Habitat.—Amballa, Punjab. Type from Handiserah.

Type.—Old male. B. M. No. 8.3.3.5. Original number 229. Collected 6th December 1907, and presented by Col. H. N. Dunn, R.A.M.C.

This subspecies differs from its near ally *M. m. pallidior* by its more buffy coloration and shorter tail.

(C)—A NEW GENUS OF MURIDÆ.

BY OLDFIELD THOMAS.

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In the previous note mention was made of Hazaribagh as a locality for *Millardia mettada mettada*, a record resting on a specimen (Collector's number 5127; B. M. No. 15.4.3.135), obtained by Mr. Crump on Mt. Paresnath, at an altitude of 4,300'.

The specimen was determined as a Mettad by Mr. Wroughton, and was catalogued as such in his Report No. 19, on the Behar Orissa collection.

So far as the skin is concerned I cannot believe this determination to be incorrect. Not only does the skin agree absolutely in colour and proportions with typical *mettada*, but its foot-pads and mammae are both as in that species.

But the skull assigned to it is obviously entirely different from that of *Millardia*, and since the identity of the skin with *Millardia* seems too complete to be due merely to accidental resemblance I suppose the skull not to belong to it, and to need separate determination.

Such determination however I quite fail to make, and now consider the skull to represent a new genus, which may be called

DIOMYS, g. n.

External characters unknown (or, if I am wrong in the above supposition, absolutely as in *Millardia*).

Skull lightly built, its anterior part long, low and narrow, the muzzle and nasals particularly long and narrow. Nasals abbreviated anteriorly so that the incisors and the front part of the nasal chamber are visible in front of them from above. Interorbital region of normal shape, the supraorbital ridges well developed, but not excessively so. Zygomatic plate long horizontally, well projected forwards, its anterior edge vertical. Anterior palatal foramina very long, reaching well between the molars, well open, their sides parallel. Posterior palatal foramina small. Mesopterygoid fossa parallel-sided, well open, as in *Rattus* and its allies, its breadth anteriorly nearly double that of the narrow part of the base of the pterygoids bounding it on each side. Bullae not preserved in the only specimen available.

Upper incisors light and slender, more thrown forward than usual, their angle to the tooth row about 88°; their outer edge

rounded, their front surface unusually roughened, their cutting edge slightly notched. Lower incisors very long, projecting more out of the bone than in any of the allied genera. Upper molars with the relative proportions of those of *Rattus*, and their structure on the whole more as in the Rats than in the *Mus-Leggadilla* series of genera. But the outer cusp of the anterior lamina of m^1 (t 3 of Miller) is completely absent, while there is a continuity between the two inner cusps (t 1 and 4), with the second and third median cusps (t 5 and 8) which appears to have developed earlier than the state of wear of the teeth would lead us to expect. In the second molar, the antero-internal cusp (t 1) is further back than usual, its front edge behind the level of the main median cusp (t 5) with which it is already in direct continuity by wear; the inner walls of this t 1 and the cusp behind it (t 4) very high and sharp edged. M^1 apparently of normal structure.

DIOMYS CRUMPI, sp. n.

Skull and teeth as above described.

Dimensions of type.—Gnathion to back of interparietal, 32.5; tip of nasals to back of interparietal, 31.3; front of incisors to basilar suture, 25.6; zygomatic breadth, 16.2; nasals, 11.8 \times 3; interorbital breadth, 4.7; breadth between ridges on brain case, 12; zygomatic plate, 4; palatilar length, 16.5; palatal foramina, 8.5 \times 2.5; anterior width of posterior nares, 2.2; upper molar series, 5.4; length of m^1 2.6.

Habitat.—Paresnath, Hazaribagh, Behar.

Type.—Skull only. B. M. No. 15.4.3.164. Collected by C. A. Crump. Presented to the National Museum by the Bombay Natural History Society.

Named in honour of Mr. C. A. Crump, its discoverer, whose effective collecting work in various localities has so greatly assisted the Survey.

The true affinities of this animal are by no means easy to determine. While the general look of the skull, its slender build, long narrow muzzle and notched incisor-tips suggest the *Mus-Leggadilla* series of *Muridae*, its molars, both in structure and proportions, and its well open posterior nares, are more as in *Rattus*, although no species of that genus can be found with teeth of absolutely similar structure. Perhaps *Rattus berdmorei* and *manipulus*, with their forwardly directed incisors, may represent a commencement of an approach towards it, but the approach is certainly not near enough to give rise to any doubt as to the generic distinction of the new form.

I trust it may not be long before specimens showing the external characters of this interesting animal may be obtained, while further skulls, of various ages, will help to illustrate the

detailed structure of its molars, now only known from a single well worn specimen.

Postscript:—Since the above was written Mr. Crump has seen the specimens and had the difficulty about their origin explained to him. He remembers obtaining a single rat among the rocks at the top of Mt. Pareshnath, and while not venturing to express absolute certainty, he is still inclined to believe that the skin 15.4.3.35., like as it is to that of a Mettad, really belongs to the skull, so obviously that of a very different animal. Further material can alone solve the problem, but a rocky mountain top does not sound the natural place for an animal with its posterior foot-pads aborted, as in the plain-loving *Millardia*, and so many other plain and desert mammals.

(D)—THE SPINY-MOUSE OF SIND.

BY OLDFIELD THOMAS.

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In his Mammals of India Mr. Blanford records a Spiny-mouse from Sind as *Acomys dimidiatus*, and the specimen he refers to still remaining unique so far as India is concerned, that determination has not hitherto been re-investigated, in spite of the great distance between Sind and the Sinaitic Peninsula, the type locality of *A. dimidiatus*.

Now however, at Mr. Wroughton's request, I have carefully examined this specimen, and find, as is not surprising, that it cannot be referred to *A. dimidiatus* and apparently needs description as new.

Acomys flavidus, sp. n.

Allied to *A. dimidiatus*, but colour paler, and no line of demarcation present on sides.

Relative development of fur and spines about as in *dimidiatus*. the spines not extending forward to the head, as is the case in *russatus*. General colour above very pale yellowish sandy, about as in *A. russatus aegyptiacus*, decidedly paler than in *dimidiatus*. This colour gradually lightens on the sides, without sharp line of demarcation, to yellowish white, the whole of the undersurface and the feet being of the latter colour. Tail longer than head and body, wholly white above and below.

Skull like that of *dimidiatus* in its general proportions, and the development of the cranial ridges.

Dimensions of the type, measured on the spirit specimen:—

Head and body 90 mm.; tail 101; hind foot 19.5.

Skull, greatest length 30.6; condylo-incisive length, 27.5; zygomatic breadth 14.7; nasals 11.4; interorbital breadth 4.8;

breadth across braincase between ridges 13; palatilar length 14.6; palatal foramina 7; upper molar series 4.5.

Hab.—Laki Hills, Sehwan, Sind.

Type.—Adult male in spirit. B. M. No. 91. 11. 1. 11. Collected by Mr. H. E. Watson and presented by Mr. W. T. Blanford.

This species has considerable superficial resemblance to *A. russatus*, especially to the Egyptian form of that animal, but has not its greater extension of the spines anteriorly, its heavily clad ears or black soles. No doubt it is really a pale eastern relative of *A. dimidiatus*, from which it may be distinguished by its greater pallor and the complete absence of any sharp line of separation between the yellowish of the upper surface and the white of the lower.

THE PALMS OF BRITISH INDIA AND CEYLON, INDIGENOUS AND INTRODUCED.

BY

E. BLATTER, S.J.

PART XIX.

*(With Plates C to CIII and 8 text figures.)**ZALACCA*, Reinw. Syll. Pl. Soc. Bot. Ratisb. II, 3.

("Zalacca" is said to be the name of this genus in the Moluccas.)

Gaertn. Fruct. I, 139.—Bl. Rumph. II, 158.—Wall. Pl. Asiat. Rar. III, t. 222.—Mart. Hist. Nat. Palm. III, 199, 325, t. 118, 119, 123, 136, 159, fig. 3. 173, 174.—Kunth Enum. Pl. III, 202.—Walp. Ann. V, 826.—Miq. Fl. Ind. Bat. III, 80.—Griff. Calc. Journ. Nat. Hist. V, 6.—Kurz. For. Fl. II, 511.—Benth. & Hook. Gen. Pl. III, II, 932, 103.—Hook. Fl. Brit. Ind. VI, 472.

Stemless, soboliferous, armed palms. Leaves pinnatisect, not flagelliferous. Leaflets narrowly linear-lanceolate.

Spadix interfoliar, pendulous, flowering branches catkin-like. Spathes persistent; lower sheathing, incomplete; bracteoles cupular, 2-celled; flowers coriaceous, densely crowded, polygamous. Male flowers: calyx tubular, 3-fid; corolla tubular, segments valvate; stamens 6, anthers short. Female flowers larger; perianth accrescent; calyx trifid; corolla-lobes lanceolate, valvate; staminodes 3-6; ovary 3-celled, stigmas 3, subulate; ovules basilar.

Fruit globose or obovoid, 1-3-seeded, clothed with reversed or spreading scales. Seeds 1-3, erect, top excavated; testa crustaceous; outer coat fleshy; albumen equable; embryo sub-basilar.

Species 10.—Indo-Malayan.

Cultivation in Europe.—The species of this genus are stove plants. They thrive in strong loam and river sand, in moist heat. The pots must be well drained to prevent any stagnation.

ZALACCA SECUNDA, Griff. in Calc. Journ. Nat. Hist. V, 12; Palms Brit. Ind. 14, t. 177; Becc. Males. III, 673.—*Calamus collinus*, Griff. Palms Brit. Ind. t. 186 (leaf only).

This species is very imperfectly known. Griffith describes the male spadix before the opening of the flowers and gives the figure of an incomplete leaf, whilst Hooker was in possession of a leaflet, a young fruit, and some ripe fruits in a broken condition.

Leaves 30 feet long; leaflets 33 inches long, nearly 3 inches broad, straight, coriaceous, concolorous, with 3 stout costæ acute on both surfaces and spinulose beneath, margins setulose above the middle.

Male spadix compact, about 2 feet long, slightly curved, closely imbricated with the scarious, striated, split spathes. Spikes stalked, exserted; stalks nearly as long as the spathes, also covered with imbricated spathes, the uppermost of which resemble those of the flowers, except in not producing any villosity. The spikes themselves are $2\frac{1}{2}$ and 3 inches long, and scarcely $\frac{1}{2}$ inch in diameter, the bracts both of the base and apex appearing to be empty.

Female spadix paniculately branched, spikes tomentose. Male flowers: bracts rounded, distinct, and presenting on the outer side of each flower a tuft of hair. Flowers densely crowded, so that their disposition is not at first apparent, the buds depressed at the apex. Calyx tripartite to about the middle, scarious, striate, segments oblong, concave. Corolla (which was not seen by Griffith in an expanded state) about the length of the calyx, divided not quite to the middle, segments oblong, concave. Stamens united to the petals as high as the base of the segments. Filaments (free) obsolete. Anthers oblong. Female flowers? Fruit appears to be ovoid, 2 inch? long, ending in a stout cone; pericarp thin, clothed with spreading and ascending subulate-lanceolate, recurved, dark brown scales $\frac{1}{4}$ inch long and under; no appearance of a succulent endocarp. Seeds 1-1 $\frac{1}{4}$ inch long, various in shape, from subglobose to hemispheric or trigonous with a convex back, and very rounded angles, dark brown, not polished, with a deep small, apical hollow leading to the canal which extends more than half way into the dense albumen; embryo above the base dorsal or sublateral, indicated externally by a circular convexity with depressed margins $\frac{1}{4}$ inch in diameter or less.

HABITAT.—Upper Assam, in forests about Kujoo; the Mishmi Mountains, and on the lower ranges of hills on the borders of Upper Assam.

ZALACCA WALLICHIANA, Mart. Hist. Nat. Palm. III, 200, 325, t. 118, 119, 136; Kurz in Natuurk. Tijdschr. Ned. Ind. XXVII (1864), 216; For. Fl. II, 511; Becc. Males. III, 66; Hook. Fl. Brit. Ind. VI, 478; Brandis Ind. Trees, 649.—*Zalacca edulis*, Wall. Cat. n. 5000; Pl. As. Rar. III, 14, t. 222-224; Griff. in Calc. Journ. Nat. Hist. V, 8; Palms Brit. Ind. 10, t. 175.—*Z. rumphii*, Blume Rumphia II, 159.—*Z. macrostachya*, Griff. II. co. 13 and 16, t. 178, A, B, C; Becc. l. c. 66.

Brandis refers *Z. edulis*, Reinw. to *Z. wallichiana*; and in this he is following Griffith (Palms Brit. Ind. 10); Hooker, on the contrary says: "The Malayan *Z. edulis*, Reinw., not hitherto found in the Malayan Peninsula, has the leaflets white beneath."

Griffith's *Z. macrostachya* has been referred to *Z. wallichiana* by Beccari. He says, that it is a much stouter form with oblanceolate leaflets and spikes 3 inches long and nearly 1 inch in diameter.

NAME.—Yingan (Burm.).



Salacca Wallichiana, Mart.

An evergreen, large, tufted, stemless or almost stemless palm, 12-20 feet high or somewhat higher, all parts glabrous. Leaves 15-20 feet long, pinnate; petiole 8-10 feet long, sheathing at the base, copiously armed with 1-1½ inch long, flat, sharp, somewhat reflexed spines arranged in broken spirals; the rhachis similarly armed, but the spines becoming gradually solitary towards the upper part; leaflets inequidistant and alternate, broad-lanceolate, 3-ribbed, 2-3 feet long, distantly spinulose-ciliate, green on both sides, subulate and almost tendril-like acuminate, the upper leaflets confluent, 2-cleft, with as many lobes as leaflets united.



FIG. 1—

To the left : Terminal spike of spadix of *Z. wallichiana*, Mart.

To the right : Upper part of spadix of the same (after Griffith.)

Spadix elongate, fastigiately branched, dimorphic, one male only, with densely tomentose spikes, the other monœcious, very dense-flowered (fig. 1); each bract seems to correspond to a cluster of 3 flowers, a female between 2 males or neuters, and with 2 densely tomentose bracteoles; rhachis densely but shortly brown-scurfy.

Flowers small, rose-coloured, in short, cylindrical, pale rose-coloured, villous spikes, about 3 or more times shorter than the narrow, variously ruptured, partial spathes. Calyx divided to the base, sepals obovate-oblong, about $1\frac{1}{4}$ lin. long; corolla nearly twice as long, rigid, rose-coloured.

Drupes in dense heads, obovoid, apiculate or almost acuminate, 1 inch long or more, densely retrorsely scaled, 3-1-celled with as many arillate seeds, the scales brown, rather rigid, cordate-ovate, only the upper parts exposed and terminating in a reflexed brittle bristle up to $1\frac{1}{2}$ lin. long.

HABITAT.—Frequent in the tropical forests all over Pegu and Martaban down to Tenasserim, Penang and Singapore; Siam; Banca.

Flowers during the cold season; fruit ripens in June and July.

ILLUSTRATION.—The specimen of *Zalacca wallichiana* which is figured on Pl. C. may be seen in the Botanic Gardens of Sibpur. The photograph was supplied by Major Gage.

ZALACCA BECCARII, Hook. f. in Hook. Fl. Brit. Ind. VI, 474.

Leaflets 18-24 inches long, $1\frac{1}{2}$ inches broad, apparently equidistant, strict, concolorous, shining on both surfaces, elongate-ensiform, acuminate, tips shortly filiform, margins with strong straight setæ almost throughout their length, mid-rib stout, lateral slender, all with few scattered, black, $\frac{1}{4}$ – $\frac{1}{3}$ inch long bristles; very young leaflets pale beneath, with very long, slender, pale bristles on the ribs; rhachis with short, hooked, black claws.

Female spadix 3 feet long or more; rhachis brown woolly; lower spathe 1 foot long, upper 4-6 inches long. Spikes $2\frac{1}{2}$ inch long, $\frac{3}{4}$ inch in diameter; bracts woolly; flowers $\frac{1}{4}$ inch long; sepals and petals subequal, broadly ovate, acute.

Fruit apparently small, fruit-scales pale chestnut, with broad bases and paler recurved spinous tips.

Can easily be distinguished from *Z. wallichiana* by the long, strict leaflets with long bristles, short tips, and margins armed throughout their length. (Hooker).

HABITAT.—Rangoon.

KORTHALSIA, Bl. in Rumph. II, 166, t. 130, fig. 2.

(After Peter Korthals, a botanist of Haarlem, who explored the East Indies.)

Mart. Hist. Nat. Palm. III, 210, 343, t. 172, fig. 1; Bl. Rumph. III, t. 157, B (*Ceratolobus*); Miq. Fl. Ind. Bat. III, 74, 750, Suppl. 591.; Griff. Palms Brit. Ind. 26, t. 133, 184 (*Calamosagus*); Walp. Ann. III, 492.; Kurz For. Fl. II, 512.; Wendl. Bot. Zeitg. 1859, 174.; Becc. Males. I, 87; Benth. & Hook. Gen. Pl. III, II, 932, 104.; Hook. Fl. Brit. Ind. VI, 474.

Scandent, spinous, leaves pinnatisect; leaflets more or less cuneate or trapezoid and erose; rhachis flagelliferous; petiole short, sheath often produced into a large ligule (ochrea).

Spadix axillary, loosely branched, pendulous, sheathed with tubular persistent spathes; bracts membranous; bracteoles reduced to hairs. Flowers bisexual, crowded in cylindric catkin-like spikes; sepals orbicular or oblong; petals ovate or lanceolate, valvate; stamens 6 or more, filaments short, anthers linear; staminodes 6 or more; ovary imperfectly 3-celled; ovules basilar.

Fruit globose or ovoid, 1-seeded; pericarp thin, tessellate with recurved shining scales. Seed erect, top hollowed, chalaza lateral; albumen ruminate; embryo ventral. Species about 20, Indian and Malayan.

Cultivation in Europe.—An elegant genus of stove palms. When young, they are most effective as drawing or dining room decorations; and when in a more mature condition, they are excellent as stove ornaments and for exhibition purposes. They are easily cultivated in a compost of equal parts loam and vegetable mould. Plenty of water is required. They are propagated by seeds.

KORTHALSIA LACINIOSA, Mart. Hist. Nat. Palm. III, 211; Kurz in Journ. As. Soc. Beng. XLIII, II (1874), 207; Becc. Males. II, 74 (excl. pl. Salangore); Hooker, Fl. Brit. Ind. VI, 475.—*K. scaphigera*, Kurz l. c. 206 (excl. omnib. syn.), t. 20, 21; For. Fl. II, 513 (not of Mart.).—*K. andamanensis*, Becc. Males. II, 76.—*Calamosagus laciniosus*, Griff. in Calc. Journ. Nat. Hist. V, 23, t. 1; Palms Brit. Ind. 27, t. 183.

Stems slender, $\frac{1}{2}$ inch in diameter. Leaves 2-4 feet; leaflets subapproximate, 4-7 inches long, rhomboid, ovate or trapezoid, about as long as broad, acutely erosely toothed, terminal one broadest, fugaceously white tomentose beneath; ochrea dilacerate, sparingly armed; petiole $1\frac{1}{2}$ -2 feet long, with straight spines, angular above, slightly convex below; rhachis and flagellum with reversed claws.

Spadix much branched, and covered with imbricate, smooth spathes, with short, oblique, acute, suberect limbs; branches axillary, widely spreading, similarly covered with spathes, from which the spikes project. Spikes 3-4 inches long, 3-4 lines broad, tawny-tomentose, very compact, the pedicels almost entirely enclosed. Bracts rounded and imbricate, the lowermost empty, a little longer than the villous bracteoles. Flowers appear to be solitary, half immersed in the wool, which is exceedingly dense. Calyx short, with 3 broad, acute teeth. Corolla deeply tripartite, segments oblong, spreading, exserted. Stamens 6, united to the corolla at the base of its segments; free portion of the filaments broad, very short, united into a short annulus; anthers large, linear, subsagittate. Ovary occupying the corolla-tube, surrounded by the filaments, covered with toothed scales, after fecundation becoming exserted. Style subulate, rather long, minutely 3-toothed at the apex.

Fruit $\frac{1}{2}$ inch long, obovoid, mucronate, with greenish, brown-margined scales. Seed with a large excavation superiorly, filled

with a brown, cellular substance; albumen horny, ruminate. Embryo obconical, ventral.

HABITAT.—Burma, Andaman and Nicobar Islands.

PLECTOCOMIA, Mart. and Bl. Schult. Syst. VII, 2, 1333.

(From the Greek "Plectos," plaited, and "comê," hair.)

Mart. Hist. Nat. Palm. III, 198, 325, t. 114, 116, Fig. 11, 12.; Bl. Rumph. III, 68, t. 158, 159, 163; Kunth Enum. Pl. III, 202.; Griff. Palms Brit. Ind. 103, app. 20, t. 217-219.; Bot. Mag. t. 5105.; Miq. Fl. Ind. Bat. III, 78, suppl. 592.; Kurz. For. Fl. II, 514.; Walp. Ann. III, 474.; Wendl. Bot. Zeitg. 1859, 165.; T. Anders. Journ. Linn. Soc. XI, 11; Benth. and Hook. Gen. Pl. III, II, 934, 107.; Hook. Fl. Brit. Ind. VI, 477.

Scandent, monocarpic, spinous palms; stem very long. Leaves flagelliferous; leaflets linear-lanceolate.

Spadix simply branched; branches very long, pendulous, clothed with closely imbricating distichous, inflated, coriaceous, persistent spathes which conceal the spicate, dicecious flowers. Spikelets short, male many-flowered, female shorter, few-flowered; bracts and bracteoles subulate. Male flowers: Calyx cupular, 3-toothed, petals lanceolate, valvate; stamens 6-12, filaments cuneate below, anthers linear. Female flowers larger, perianth accrescent; corolla 3-fid, lobes valvate; staminodes 6. Ovary 3-celled; ovules basilar.

Fruit globose, 1-, rarely 3-seeded, beaked; pericarp thin, tessellated, with reflexed shining scales. Seed erect; albumen equable; embryo basilar.

Species 6—Himalayan and Malayan.

Cultivation in Europe.—Very handsome stove plants and of easy cultivation. A compost of loam and peat, in about equal parts, is suitable. Freely propagated by suckers.

PLECTOCOMIA KHASIYANA, Griff. in Calc. Journ. Nat. Hist. V, 106; Palms Brit. Ind. 106, t. 218; Mart. Hist. Nat. Palm. III, 199; Hook. Fl. Brit. Ind. VI, 478.—*P. Assamica*, Hook. Bot. Mag. t. 1505 (excl. syn.).

➤ Stem 60-80 feet, as thick as the arm. Leaves 30 feet, including the flagellum; leaflets 8-16 inches long, 2-3 inches broad, broadly lanceolate, strongly 3-ribbed, finely furfuraceous beneath tip, not filiferous; rhachis armed beneath with very short digitate spines.

Male spadix branched from the base; branches 3 feet long by 2 feet across the spathels, which are 1½ inch long, oblong, white, with broad, green, acute or acuminate tips and a broad, brown, interposed band (fig. 3). Spikelets 1-inch, many-flowered; petals ½ inch long, elongate-lanceolate; stamens 8-12. Female spadix: Spathes of the peduncle with erect, oblong-lanceolate limbs; flower-bearing branches 1-2 feet long, secund, pendulous; spathes at the base half amplexant, rather distant, distichous, and laxly imbricated; outline obovate, towards the apex broadly obtuse, margins below this part incurved; spikes concealed by the spathes, furfuraceous,

3 or 7-flowered; flowers distichous, large; calyx flat, small, divided almost to the base into 3 triangular, mucronate, smooth teeth; corolla divided almost to the base into 3 ascending, lanceolate, acuminate segments, 4-4½ lines long; staminodes 6; ovary broadly globose, covered with exceedingly numerous, shortish, very fimbriate scales with multifid points, 3-celled; style very short, stout, with 3 stout, subulate, spreading branches as long as the petals, channelled and stigmatic on their inner faces.

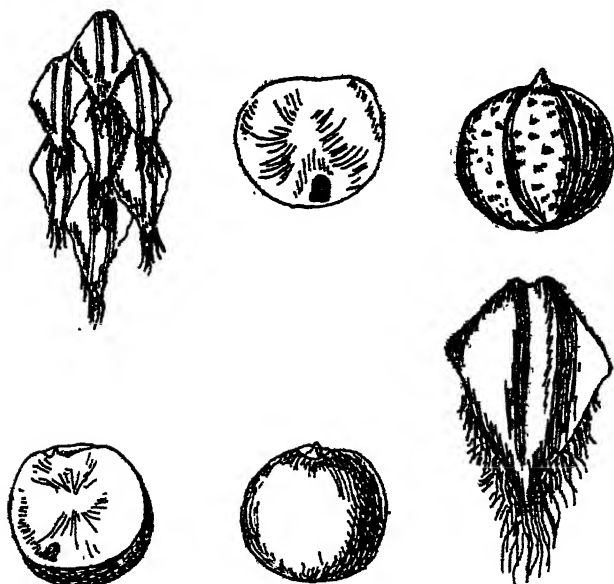


FIG. 2—

Upper row : *Plectocomia khasiyana*,

Left: Scales of fruit much magnified.

Middle: Section of seed, natural size.

Right: Seed enclosed in the flesh, natural size

Lower row : *Plectocomia assamica*.

Left: Section of seed.

Middle: Seed.

Right: Scale of fruit (after Martius).

Fruit 1-1½ inch in diameter, globose, abruptly beaked, surrounded at the base by the calyx, and corolla now flattened out, dark brown; scales very numerous, rather small, either nearly smooth, or with ciliate margins and recurved, split, fimbriate points. Seed covered with a rather thick, brown, cellular, spongy substance; albumen solid, horny; embryo basilar (fig. 2).

HABITAT.—Khasia Hills, 4-5,000 feet.

PLECTOCOMIA HIMALAYANA, Griff. in Calc. Journ. Nat. Hist. V, 100; Palms Brit. Ind. 108, t. 219; Mart. Hist. Nat. Palm. III, 199; T. Anders. in Journ. Linn. Soc. XI, 12; Hooker Fl. Brit. Ind. VI, 478.—*P. montana*, Herb. Ind. Or. Hook f. & Th.

NAMES.—Takri Bet (Nep.); Ranul (Lepcha); Rattan Palm (Engl.).

Stem 1 inch in diameter. Leaves 6-8 feet long, including the flagellum; leaflets 12-16 inches long, $1-1\frac{1}{2}$ inch broad, alternate, linear-lanceolate, very acuminate, narrowed into filiform tips, 2-3 inches long, with five prominent veins on the upper surface, margins with short, sub-appressed spinescent teeth; rhachis scurfy; the pinniferous part of the petiole armed below with stout, hooked prickles, confluent at the base; prickles in increased number on the flagellum; petiole unarmed or margins spiny; sheath tubular, scurfy; spines whorled.

Spadices erect; branches 2-3 feet long, covered with rust coloured tomentum; spathes almost stem-clasping, conduplicate, coriaceous-scarious; spathelets 1-2 inches long, rhomboid, acute; spikelets 3-7-flowered, scurfy, tomentose. Male flowers supported by 3 narrow, bristle-pointed, scarious bracts, sub-distichous; calyx cupular, with 3 short, rounded teeth ending in bristles; petals $\frac{1}{4}$ inch long, ovate-lanceolate. Stamens 6, united at the base into a short cup; filaments stoutish, subulate; anthers large, linear-oblong, obtusely sagittate. Female flowers?

Fruit $\frac{1}{2}$ inch in diameter, depressed-globose; scales very small, fimbriate, tips appressed.

HABITAT.—Sub-Himalayan ranges about Darjeeling, 4-7,000 feet, common.

PLECTOCOMIA MACROSTACHYA, Kurz. in Journ. Asiat. Soc. Beng. XLIII, II, 207, t. 16, 17; For. Fl. II, 514; Hook. Fl. Brit. Ind., VI, 478; Brandis Ind. Trees, 650.

NAME.—Kyeinbam (Burm.).

An evergreen lofty climber, all parts glabrous. Leaves pinnate, the petiole and rhachis spiny, spines straight, up to $\frac{1}{2}$ inch long; leaflets (median ones) somewhat approximate by pairs, linear-lanceolate, $\frac{1}{2}$ -2 feet long, long-acuminate, white-powdery beneath, 3-ribbed, 2 of the ribs marginal, coriaceous, but rather flaccid.

Branches of male spadix 4-5 feet long, pendulous, closely covered with broadly obovate distichous imbricating, spathels, brown with black border, in the axils of which are the spikelets, shorter than bracts with alternate, distichous flowers. Male flowers: calyx wide, cup-shaped, about 1 line deep, shortly 3-toothed, the teeth acute, bordered, especially in their sinuses, by a dense, brown, woolly tomentum; petals rigid, falcate, lanceolate, sharply acuminate, about $\frac{1}{2}$ inch long or somewhat longer, sulcate outside; stamens 6.

Drupes $\frac{3}{4}$ -1 in diameter.



Plectocomia elongata, Mart.



Plectoconia assamica, Griff.

HABITAT.—Tenasserim : Bithoko range, between the Yünzalin and the Salween at Great Rapids, 3,000 feet elevation.

PLECTOCOMIA ASSAMICA, Griff. in Calc. Journ. Nat. Hist. V, 97, Palms Brit. Ind. 107, t. 218, a; Mart. Hist. Nat. Palm. III, 199, t. 176 f. 11.

Leaves very large; leaflets 18-24 inches long, 2-2½ inches; broad, white, finely furfuraceous beneath, tip not thread-like, ribs slender, lateral ribs marginal; petiole 1½ inch broad, with short, stout, marginal spines and short, seriate, scattered clusters of more slender, dorsal ones.

Branches of fruiting spadix 4-5 feet long by 4-5 inches across the large, subacute, nearly glabrous spathels, scurfy, rhachis rusty tomentose; spathels 2½-inches long. Spikelets 8-10-flowered. Male calyx cupular, 3-toothed, sepals broadly ovate, ¼ inch long, petals lanceolate, ½-⅓ inch long. Fruiting sepals broadly ovate, ¼ inch long; petals lanceolate, ½ inch long.

Fruit, when dry, of a rich ferruginous brown colour, about 1 inch in diameter, surrounded at the base by calyx and corolla, terminated by a style tripartite almost to the base with subulate connivent branches, one-celled, very villous from the highly ciliate, fimbriate, split, recurved points of the scales. Albumen cartilaginous, solid, its tissue radiating from the centre; embryo basilar (see fig. 2).

HABITAT.—Upper Assam.

ILLUSTRATION.—The tuft of *Plectocomia assamica* represented on Pl. CI grows in the Bot. Gard. of Sibpur. We have to thank Major Gage for the photograph.

PLECTOCOMIA ELONGATA, Mart. in Roem. & Sch. Syst. VII, 1333, Hist. Nat. Palm. 199, t. 114 and 116, f. 1; Kunth Enum. III, 202; Blume Rumphia, III, 68, t. 158 and 163 A; Hook. f. Fl. Brit. Ind. VI, 479.—*C. maximus*, Reinw., ex Blume Cat. Hort. Bogon. 59.

Leaves very large; petiole short; leaflets 1-1½ foot long, 2 inches broad, rather membranous, sparsely white furfuraceous beneath, tip not filiferous, costæ 3, very slender, lateral costæ marginal.

Branches of spadix 3-4 feet long, 2-3 inches across the spreading spathels (fig. 3). Spathels 1½ inch long, sub-3-lobed, acute, glabrous. Flowers very small; calyx of male minute, 3-toothed; petals ¼ inch long, obliquely oblong-ovate, acute. Calyx of female larger, urceolate, 3-toothed, petals small, linear-lanceolate.

Fruit 1 inch in diameter, densely villous from the long lacerate spreading tips of the scales.

HABITAT.—Penang, Sumatra, Java.

ILLUSTRATION.—Mrs. Burkill was kind enough to take a photograph of the specimen of *Plectocomia elongata* which grows in the Bot. Gard. of Singapore (Plate CII).

CALAMUS, L. Gen. Pl. ed. 1764, 173, No. 436.

(From the Greek "Calamos," a reed or cane).

Mart. Hist. Nat. Palm, III, 207, 331, t. 112, etc.; Gærtn. Fruct. II, t. 139; Bl. Rumph. III, 28, t. 146, 154, 163; Griff. Calc. Journ. Nat. Hist. q. 26; Miq. Fl. Ind. Bat. III, 103, 719.; Kurz For. Fl. II, 515.; Benth. Fl. Austr. VII, 134.; Wendl. Bot. Zeitg. 1859, 158; Drude Bot. Zeitg. 1877, 637; T. Anders. Journ. Linn. Soc. XI, 8.; Luers. Botan. II, 331.; Hook. Fl. Brit. Ind. VI, 436; Becc. in Ann. Roy. Bot. Gard. XI, 61.

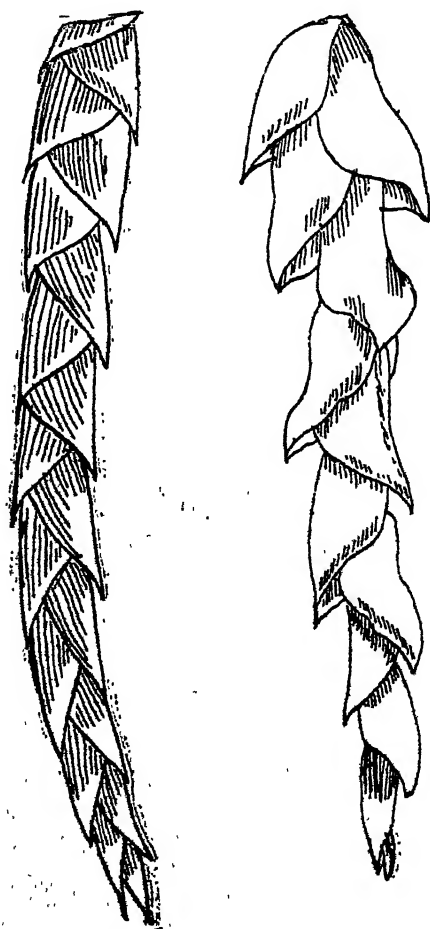


FIG. 3—

Left : Tip of female spike of spadix of *Plectocomia elongata*.

Right : Tip of spike of *Plectocomia khasiyana*.

Perennial, armed, tufted palms, rarely erect, usually climbing means of hooked spines on the rhachis of the leaves, or by whip-

like spinous prolongations (flagella) of the rhachis, or of the spadix, or of the leaf sheath; stem simple, cylindric, ringed at the nodes, upper internodes clothed with spinous leaf-sheaths. Leaves pinnatisect, rarely digitate, alternate; leaflets few or many, lanceolate, rarely broad, acuminate, nerves parallel; sheath armed, produced into a ligula or ochrea and with or without a lateral armed flagellum. Spadices axillary, usually elongate, much branched, armed, sometimes produced into a spinous flagellum. Spathes tubular or open, sheathing the peduncle and branches of the spadix, and passing into bracts and bracteoles (spathels and spathe-lules). Flowers small, usually polygamo-dicecious, in usually distichous often scorpioid spikelets, solitary or binate (a female or male or both) in the bracteoles. Male flowers: calyx cupular, 3-lobed or 3-toothed, coriaceous; petals 3, acute, coriaceous, valvate, sometimes combined at the base into a stipes; stamens 6, filaments short, anthers dorsifixed, versatile. Female flowers slightly accrescent; calyx as in male; corolla tubular below, 3-fid, valvate; staminodes forming a cup; ovary incompletely 3-celled, clothed with retrorse scales; style short or rather long; stigmas 3; ovule basilar, erect, (Fig. 4 and 5.)

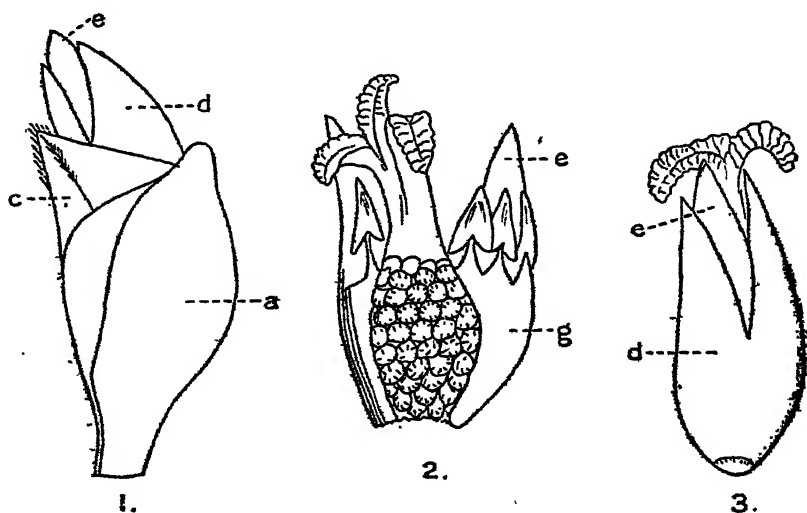
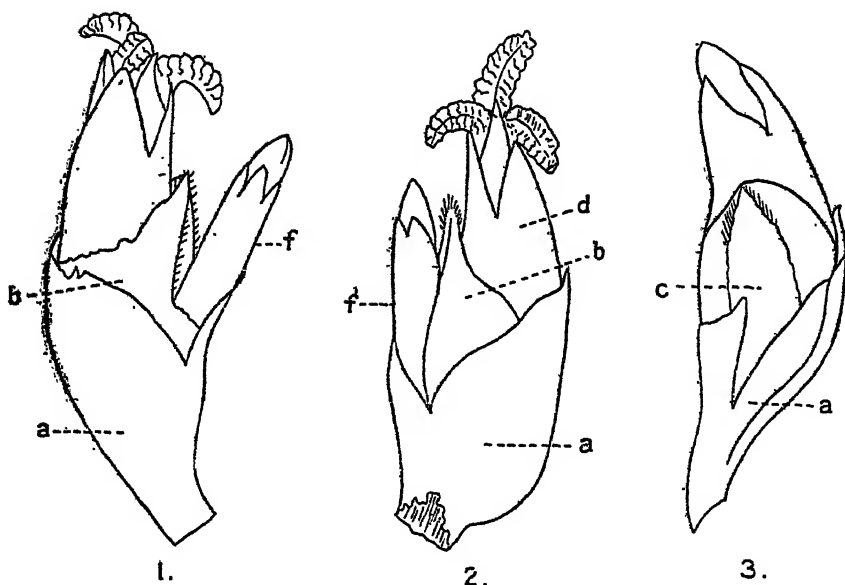


FIG. 4.—*Calamus griffithianus*.

1. Female flower with its involucre still closed; back view of the involucrephorum (a).
2. Female flower cut open: g = staminal tube.
3. Female flower without involucre; d = calyx, e = corolla.

Enlarged 6 diam. (After Beccari).

FIG. 5—*C. griffithianus*.

1. Female flower during anthesis.

a=involucrophorum, b=involucre, f=nenter flower.

2. Another female flower with its involucre during anthesis.

3. Female flower with its involucre still closed. c=areola.

Enlarged 6 diam. (After Beccari).

Fruit globose or ellipsoid, usually strongly beaked; style terminal; pericarp thin, clothed with appressed deflexed closely imbricating polished scales. Seed subglobose or oblong, smooth or pitted; albumen equable or ruminant; embryo ventral or basal.

Species over 200.—Tropical and sub-tropical Asia, Malaya, Philippines, New Guinea, Australia, and a few in tropical Africa.

The Calami are mostly leaf-climbers with thin reedy stems. In some species there are hooks on the back of the midrib, but the more common type of leaf is one in which the leaflets at the outer end of the leaf are represented by stout spines pointing backwards.

The leaf shoots almost vertically out of the bud up among the surrounding vegetation, and the hooks take hold. The stem often grows to immense lengths (500-600 feet).

ECONOMIC IMPORTANCE.—"The Forest Departments of the various provinces in India, including Burma, publish annual reports from which it might be gathered that the yearly crop of canes amounts to about 10,000,000 maunds and the annual revenue therefrom from Rs. 50,000-60,000. The Reports of the Conservators of Forests in Burma for the year 1904-5, for example, show a total revenue from canes amounting to Rs. 37,775. The imports of canes and rattans into India from foreign countries may be said to average from 30,000

to 40,000 cwts., valued at from 2 to 3½ lakhs of rupees (38,436 cwts. valued at Rs. 3,85,674 in 1906-7). These come mainly from the Straits Settlements and Siam. The exports to foreign countries of Indian canes come to from 1,000 to 3,000 cwts., valued at from Rs. 20,000 to Rs. 50,000 (2,427 cwts., valued at Rs. 38,100 in 1906-7), but in addition there is also a re-export trade formerly of about the same quantity and value as that just mentioned, but showing a considerable diminution in recent years (673 cwts., Rs. 11,291, in 1906-7). It is thus significant that India, with its vast supplies of canes and rattans should not be independent of foreign tropical countries, and the explanation may possibly lie in the cheaper sea as compared with land transit. Large towns like Bombay, Calcutta, and Madras find it more economical to obtain their supplies from the Straits than from the inland forests of India." (Watt).

Popular names for *Calamus* in general and its products :

FOR THE PALM.

English : Canes, rattan, rattan palm, reed palm, rotang.

French : Canne épineuse, ratan, rotain, rotang, rotin.

German : Binsenhaln, Binsenstengel, Rohrpalme, Rotangpalme, Rottang, Schilfpalme.

Dutch : Palmriet, rotanpalm, rotan, rottangpalm, rottan, rottanpalm, rotting, rottingriet, rottinggewas, spaansch riet.

OF THE CANE.

English : Ratoon, rattan, rattan cane.

French : Canne à main, jonc, jonc d'Inde, rotan, rotin.

German : Handratting, Malaccarohr, Manillarohr, Rohr, Spanisches Rohr, Stockrohr, Zuckerrohr.

Dutch : Rotting, spaansch riet.

OF THE WOOD.

English : Cable cane, chair-bottom cane.

French : Liane d'amarrage?, rotang à cordes, rotang à meubles.

German : Bindrohr, Bundrohr, Ratang, Rattan, Rohr, Rotang, Rotting Schnurrohr, Stuhlrohr.

Dutch : Bindrottan, bindrotting.

Of native generic names for *Calamus* we mention the following taken from Beccari :—

In Ternate : Uri.

In Makassar : Boucan.

In Banda and Amboina : Ua.

In the Philippines : Bejuco.

In Java : Penjalin, Hoeh, Hooek.

In China : Khoë, Khoëa.

In Cochin China : May.

Hindustani : Bet.

Sanskrit : Vetra, Vetus.

Cultivation in Europe.—"Although the species of *Calamus*, the cultivation of which has been attempted in the hot houses of extra-tropical countries are pretty numerous, the number of those which have become permanently established is small, owing to its being very difficult to provide them with conditions of existence like those enjoyed in their native countries. The Calami in our hot houses therefore give but a faint and poor idea of the elegance of their foliage as it appears at the summit of a long, slender and climbing stem. Young plants of Calami are, however, considerably appreciated by horticulturists on account of their highly ornamental, bright green, graceful pinnate leaves, so that they are frequently offered for sale in commercial catalogues of leaving plants.

"In cultivation Calami thrive best in a compost of equal parts of sandy loam and vegetable soil formed by decomposed leaves. They require a warm moist atmosphere and copious watering. I have however to observe that Calami grow in very different situations, from marshy plains at the level of the sea up to an elevation of 2,000 metres in the mountains, so that in the cultivation of Calami, as in that of any other plant, it is necessary to know beforehand the natural conditions of their existence and to modify their cultural conditions accordingly. If this be borne in mind, it may be found that probably not a few of the mountain species of *Calamus*, as for instance those of the Himalaya and Assam, will thrive better in the temperate than in a warm hot-house, while others should receive the treatment of aquatic plants in warm water." (Beccari).

CONSPECTUS OF THE SPECIES.¹

A.—LEAVES NEVER CIRRHIFEROUS.

Group I.—Leaflets many, elongate. Primary spathes elongate-tubular, dilated and lacerate in their upper part. Spadix with their partial inflorescences and spikelets provided with a pedicellar part which remains included in their respective spathes. Fruiting perianth explanate (not forming a pedicel to the fruit). Involucrophorum of the female spikelets short, not pedicelliform. Seed with ruminate albumen; embryo basilar or nearly so:

a. Stem erect. Leaf-sheaths not flagelliferous.

1. *O. erectus*.

b. Scandent. Leaf-sheaths flagelliferous.

2. *C. flagellum*.

¹ In this and the following descriptions of the species of *Calamus* I could not do better but to copy from Beccari's admirable Monograph on "The Species of *Calamus*," which appeared as Vol. XI of the Annals of the Royal Bot. Gard., Calcutta. It had been my intention to omit his genus altogether; but some Botanists in Europe advised me to include it. Two reasons induced me to follow their advice, on the one hand, the fact that unfortunately very few people have access to Beccari's work, on the other, the more selfish consideration that my series on the Indian Palms would be incomplete by excluding the Genus *Calamus*, a genus which is better represented in India than any other.

Group II.—Leaflets numerous, elongate. Primary spathes elongate-tubular, more or less lacerate in their upper part. Fruiting perianth explanate. Involucrophorum short, not pedicelliform. Seed (where known) with equable albumen and basilar embryo:

a. Spikelets not inserted at the bottom of their respective spathes and therefor not or very shortly pedicellate:

* Not scandent. Spadix not flagelliform, and armed only with straight spines.

3. *C. arborescens*.

** Scandent. Spadix flagelliform, clawed on the axial parts between the partial inflorescences.

4. *C. longisetus*.

5. *C. thwaitesii*.

6. *C. leptospadix*.

b. Spikelets inserted at the bottom of their respective spathes and provided with a distinct pedicellar part.

7. *C. dilaceratus*.

Group III.—Leaflets very few, pinnate, digitate or radiate. Primary spathes very narrow and elongate-cylindric, very closely sheathing. Leaf-sheaths flagelliferous. Spadices (male and female) simply decompound, very slender and flagelliform; partial inflorescences and spikelets inserted at the mouth of their respective spathes (not with a pedicellar part). Fruiting perianth explanate. Involucrophorum not pedicelliform. Seed with equable albumen and basilar embryo.

8. *C. pachystemonus*.

9. *C. digitatus*.

10. *C. radiatus*.

Group IV.—Leaves pinnate. Leaf-sheaths provided in the scandent species (when not bearing spadices) with a long-clawed flagellum; in the non-scandent species the flagellum rudimentary or none. Primary spathes very elongate-tubular, closely sheathing, sometimes split longitudinally in their upper part, but never entirely opened longitudinally and laminar. Spikelets inserted at the mouth of their respective spathes. Involucrophorum not pedicelliform. Seed (where known) not ruminant; embryo basilar.

a. Fruiting perianth (where known) explanate or subcallos at the base, not or slightly pedicelliform.

† Leaves pinnate with few often broad-lanceolate or elliptic or more rarely elongate, 3-5-costulate leaflets, all the costæ reaching the apex.

* The two terminal leaflets highly connate.

11. *C. floribundus*.

** The two terminal leaflets free at the base.

12. *C. kingianus*.

†† Leaves with numerous leaflets, these narrow, often fascicled, usually gradually decreasing towards the apex, the two of the terminal pair the smallest and free at the base.

* Fruiting perianth entirely explanate.

13. *C. viminalis*.
14. *C. concinnus*.
15. *C. rivalis*.
16. *C. pseudo-rivalis*.
17. *C. metzianus*.
18. *C. pseudo-tenuis*.

** Fruiting perianth slightly callous at the base and more or less pedicelliform.

20. *C. delicatulus*.
21. *C. helferianus*.
22. *C. nicobaricus*.

b. Fruiting perianth distinctly pedicelliform.

* Leaflets numerous, narrow, equidistant, gradually becoming smaller towards the apex of the leaf.

23. *C. tenuis*.
24. *C. rotang*.
25. *C. delessertianus*.

** Leaflets not very numerous, and distinctly fascicled.

26. *C. Brandisii*.

*** Leaflets more or less inequidistant, but not fascicled, many-nerved.

27. *C. acanthospathus*.
28. *C. feanus*.

Group V.—Leaflets elongate. Primary spathes very long, tubular and closed at first, later longitudinally split and open, loriform or laminar. Involucrophorum not pedicellate. Seed (where known) not alveolate, with equable albumen.

29. *C. guruba*.
30. *C. nitipus*.
31. *C. platyspathus*.
32. *C. myrianthus*.
33. *C. hypoleucus*.
34. *C. leucotes*.

Group VI.—Leaflets elongate. Leaf-sheaths flagelliferous. Primary spathes at first tubular, later more or less split longitudinally and partly laminar. Involucrophorum distinctly pedicellate. Fruiting perianth pedicelliform.

35. *C. travancoricus*.
36. *C. rheedei*.

Group VII.—Leaflets elongate. Leaf-sheaths flagelliferous. Primary spathes tubular, strictly sheathing, not split or lacerate. In-

volucrophorum distinctly pedicellate. Fruiting perianth pedicelliform. Seed with deeply ruminant albumen.

37. *C. huegelianus*.

38. *C. gamblei*.

Group VIII.—Leaflets elongate and narrow. Leaf-sheaths flagelliferous. Primary spathes strictly sheathing. Involucrophorum in the female spikelets not pedicelliform. Fruiting perianth pedicelliform. Seed deeply ruminant.

39. *C. gracilis*.

40. *C. melanacanthus*.

B.—LEAVES DISTINCTLY CIRRIFEROUS.

Group IX.—Leaf-sheaths not flagelliferous. Spadix not flagelliferous at its apex, usually shorter than the leaves. Primary spathes elongate-tubular, closely sheathing. Male spadix ultra-decompound. Female spadix simply decompound, differing considerably from the male one. Male and female spikelets stalked or inserted at the base of their respective spathes by means of a distinct pedicel. Fruiting perianth explanate. Seed with ruminant or equable albumen.

41. *C. zeylanicus*.

42. *C. ovoideus*.

43. *C. andamanicus*.

Group X.—Leaf-sheaths not flagelliferous. Spadices usually shorter than the leaves, not or slightly flagelliferous at the apex. Spikelets not stalked, inserted near the mouth of their respective spathes. Fruiting perianth pedicelliform or almost explanate. Seed with more or less superficial intrusions of the integument or distinctly ruminant; embryo basilar or slightly shifted to one side.

44. *C. palustris*.

45. *C. latifolius*.

46. *C. dorcei*.

47. *C. polydesmus*.

48. *C. khasianus*.

49. *C. nambariensis*.

50. *C. inermis*.

51. *C. unifarius*.

1. *CALAMUS ERECTUS*, Roxb. Fl. Ind. III, 774; Mart. Hist. Nat. Palm. III, 11H.; Griff. in Calc. Journ. Nat. Hist. V, 35, and Palms Brit. Ind. 43, Pl. CXC, A. f. i. (as *C. acanthospathus*); Kurz in Journ. Asiat. Soc. Beng. XLIII, Pl. 2, 209, Pl. XXIII and XIV (excl. *C. longisetus*, Griff.), and For. Fl. Brit. Bur. II, 516, and Rep. Veg. Pegu 90; Hook. f. Fl. Brit. Ind. VI, 439 (excl. *C. schizospathus*); Becc. in Rec. Bot. Surv. Ind. II, 197, and Ann. Roy. Bot. Gar., Calcutta, XI, 121.—*C. macrocarpus*, Griff. in Mart. Hist. Nat. Palm. III, 333, t. 176, f. X, et t. ZXVIII, f. XXIV; Griff. Palms Brit. Ind. 40, Pl. CLXXXVI, A. f. I-II.—*C. erectus macrocarpus*, Becc. in Hook. Fl. Brit. Ind. VI, 439.—*C. collinus*, Griff. in Calc. Journ. Nat. Hist. V, 31, and Palms Brit. Ind. 39 (excl. descr. fol.) t. CLXXXV (*spadix tantum*); Mart. Hist. Nat. Palm III, 332.—*C. erectus*, var. *collina* Becc. in Hook. f. Fl. Brit. Ind. VI, 439.

NAMES.—Kadam bet (Beng.), Thaing (Burm.), Sun-gutta (in Sylhet).

DESCRIPTION.—Stem erect, robust, with a crown of large leaves. Ochrea very large, divided into two large hispid auricles. Leaves 3-5 m. long. Leaflets very numerous, equidistant, elongate-ensiform, green on both surfaces, mid-rib sparingly bristly, secondary nerves naked on both surfaces. Leaf-rhachis armed beneath with long straight spines. Spadix not very shortly flagelliferous at its apex (fig. 6). Primary spathes loosely sheathing, speedily lacerated

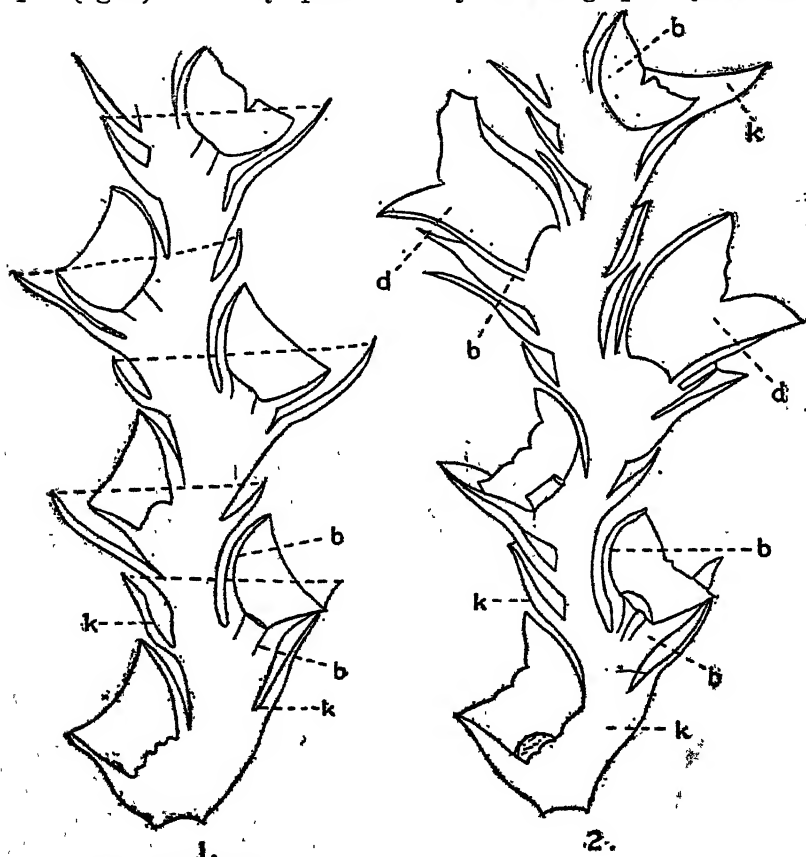


FIG. 6.—*Calamus erectus*.

1. Outline of right hand figure to show the relative position of the spathels (*k*) and of involucre (*b*). The dotted line completes that portion of the margin of the spathe which is not seen in the right hand figure.
2. Portion of a male spikelet in longitudinal section. The involucres (*b*) are half immersed in the spathels (*k*). In the upper part is the calyx (*d*) of two flowers still attached to their involucre.

Enlarged 6 diam. (From Beccari).

and marcescent. Fr. 3-4 cm. long ellipsoid. Seed oblong or ovoid, circular in transverse section. Embryo basilar, eccentric (fig. 7).

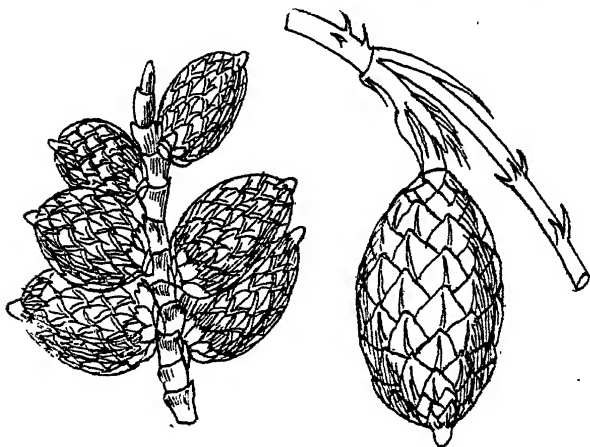


FIG. 7.—*Calamus erectus*.

Left : Top part of branch of spadix.

Right : Part of fruiting spadix with one fruit (After Griffith).

HABITAT.—Sylhet, Khasia Hills, Upper Assam, Chittagong.

USES.—In Sylhet the poorer natives use the seeds as a substitute for that of *Areca* (Roxb.).

CALAMUS ERECTUS, Roxb. var. *schizospathus*, Becc. in Ann. Roy. Bot. Gard. Calc., XI, 125.—*C. schizospathus*, Griff. in Calc. Journ. Nat. Hist. V, 32; Palms Brit. Ind. 41, Pl. CLXXXVII; Mart. Hist. Nat. Palm. III, 332; T. Anders. in Journ. Linn. Soc. XI (1889), 71; Gamble Man. Ind. Timb. 423; Becc. in Rec. Bot. Surv. Ind. II, 197.—*C. erectus*, Becc. (*partim*) in Hook. f. Fl. Brit. Ind. VI, 438.

NAMES.—Reem (Lepchas), Phekri bet (Sikkim).

DESCRIPTION.—Leaflets with a secondary nerve on each side of the mid-rib, sparingly bristly beneath and sometimes also above. Male flower with the calyx half (not almost entirely) projecting from the involucre.

HABITAT.—Sikkim.

USES.—According to Gamble the stem is about 5 cm. in diameter with hard wood and closely packed fibro-vascular bundles; the canes, however, are useless.

CALAMUS ERECTUS, Roxb. var. *birmanicus*, Becc. in Rec. Bot. Surv. Ind. II, 197, and Ann. Roy. Bot. Gard. Calc. XI, 70 and 126.

DESCRIPTION.—Female spadix more slender than in the type, produced into a rather long (75 cm.) flagelliform aculeate appendix. Fruit smaller.

HABITAT.—Burma, on the Karen mountains at 1,000–1,200 m.

2. *CALAMUS FLAGELLUM*, Griff. in Mart. Hist. Nat. Palm. III, 333, Pl. 176, f. IX; Palms Brit. Ind. 48; T. Anders. in Journ. Linn. Soc.

XI (1869), 8; Gamble Man. Ind. Timb. 423; Hook. Fl. Brit. Ind. VI, 439; Becc. in Rec. Bot. Surv. Ind. II, 197, and Ann. Roy. Bot. Gard. Calc. XI, 70, 127.—*C. jenkinsianus*, Griff. Palms Brit. Ind. 40, Pl. CLXXXVI A. f. iii (non pag. 89).—*C. polygamus*, Roxb. Fl. Ind. III, 780?

NAMES.—Rabi Bet (Nepal), Reem (Lepchas), Nagagola Bet (Assam).

DESCRIPTION.—Scandent and robust. Leaf-sheaths with very unequal never seriate spines. Ochrea marcescent. Leaf-sheath-flagella up to 6-7 m. long. Leaves very large. Leaflets numerous, equidistant, green on both surfaces, broadly ensiform, strongly unicastate; the mid-rib with a few subspiny bristles, secondary nerves naked on both surfaces. Leaf-rhachis clawed on the back. Spadix elongate, flagelliform. Primary spathes tubular, closely sheathing, lacerated at apex. Fr. about 3 cm. long, broadly ovoid. Seed ovoid, circular in transverse section; embryo basilar.

HABITAT.—N.-E. India, Assam, Khasia Hills, Eastern Bengal, Sikkim.

USES.—The fruit is edible (Hooker). The canes are soft and useless (Anders.).

CALAMUS FLAGELLUM, Griff. var. *karinensis*, Becc. in Ann. Roy. Bot. Gard. Calc. XI, 70, 129.

DESCRIPTION.—Leaf-sheaths armed with very unequal spines, some being large and others small and seriate.

HABITAT.—Burma, Karen mountains at 1,200-1,400 m.

3. *CALAMUS ARBORESCENS*, Griff. in Calc. Journ. Nat. Hist. V, 33, and Palms Brit. Ind. 42, t. CLXXXVIII A. B. C; Mart. Hist. Nat. Palm. III, 332; Miq. Fl. Ind. Bat. III, 113; Kurz in Journ. Asiat. Soc. Beng. XLIII, Pt. II, 208, t. XXII, and For. Fl. Brit. Burm. II, 516, and Rep. Veg. Pegu (1875), 90; Gamble Man. Ind. Timb. 423; Hook. f. Fl. Brit. Ind. VI, 439; Becc. in Rec. Bot. Surv. Ind. II, 198, and Ann. Roy. Bot. Gard. Calc. XI, 70, 131.—*C. hostilis*, Hort. Calc.

NAMES.—Thanoung, Danoung, Kyenbankyen, Damon, Danoung Thain (Burm.).

DESCRIPTION.—Cæspitose. Stem erect, robust, 4-6 m. high. Leaves large. Leaf-sheaths, petiole, and leaf-rhachis armed with large, laminar, almost black, shining, seriate spines. Leaflets equidistant, broadly ensiform, green above, white underneath. Male spadix elongate, pendulous. Primary spathes tubular, rather closely sheathing, lacerated and fibrous in their upper part, armed only with straight black spiculæ and never with hooked spines or claws. Secondary spathes clavate, sub-inflated and usually lacerated and blackened. Spikelets large with flatly bifarious flowers.

HABITAT.—Pegu in Burma, common and gregarious in evergreen forests.

4. *CALAMUS LONGISETUS*, Griff. in Calc. Journ. Nat. Hist. V, 36, and Palms Brit. Ind. 44, t. CLXXXIX A. B.; Mart. Hist. Nat. Palm. III, 333; Miq. Fl. Ind. Bat. III, 114; Hook. Fl. Brit. Ind. VI, 440; Becc. in

Rec. Bot. Surv. Ind. II, 199, Ann. Roy. Bot. Gard. Calc. XI, 71, 134.—*C. tigrinus*, Kurz in Jour. As. Soc. Beng. XLIII, Pt. II (1874), 211, t. XXV and For. Fl. Brit. Burm. II, 519.

NAMES.—Leme (Burm.), Umdah, Am (Andam.).

DESCRIPTION.—Scandent. Leaves up to 3-4 m. long. Leaflets not equidistant often in groups of 2-3, almost equidistant towards the summit, green on both surfaces, ensiform, unicostate, mid-rib remotely spinulose above with some very long blackish bristles beneath. Male and female spadices simply decompound. Primary spathes elongate-tubular, lacerate in their upper part; secondary ones slightly inflated. Female spikelets very large with flatly bifarious flowers. Fr. ellipsoid-ovate, over 3 cm. long, transversely mottled like a tiger skin. Seed oblong, 5-7 costate.

HABITAT.—Pegu, Andamans.

USES.—The natives of the Andamans eat the fruit cooked. The leaflets are employed for coverings.

5. *CALAMUS THWAITESII*, Becc. in Hook. f. Fl. Brit. Ind. VI, 441; Rec. Bot. Surv. Ind. II, 199, Ann. Roy. Bot. Gard. Calc. XI, 71, 137; Trimen Fl. Ceylon IV, 330; Talb. Trees Bomb. ed. 2,344 (*partim*); Brandis Ind. Trees (1906), 652 (*partim*); Cooke Fl. Bomb. Presid. II, 807 (*partim*).—*C. longisetus*, Thw. Enum. Plant. Zeyl. 330. (non Griff.)

DESCRIPTION.—Leaves large. Leaflets irregularly fascicled, broadly ensiform, green on both surfaces, unicostate. Mid-rib with black, short subspiny bristles on both surfaces; secondary nerves naked. Male and female spadices simply decompound, flagelliform, with the axial parts between the inflorescences very elongate and strongly clawed; primary spathes very long, narrow, thinly coriaceous, closely sheathing, lacerated near the mouth. Male and female spikelets very elongate. Fr. ellipsoid or obovate-elliptic, suddenly contracted into a conic beak, about $2\frac{1}{2}$ cm. long; scales in 12 series broadly channelled along the middle. Albumen equable; embryo basal.

HABITAT.—Ceylon. Moist low country, below 2,000 ft., rather rare, Kalutara, Kandy, Hantane, Rambukkama, Kurmegala.

FLOWERS.—February to May.

CALAMUS THWAITESII, Becc, var. *canaranus*, Becc. in Ann. Roy. Bot. Gard. Calc. XI, 71, 138.; Cooke Fl. Bom. Pres. II, 807 (*partim*).

NAME.—Handibet (Kanara).

DESCRIPTION.—Male spikelets with more numerous and more approximate flowers. Seeds more flattened than in the type specimen.

HABITAT.—Kanara, common in the evergreen forests at the foot of the Nilkund Ghat.

FLOWERS.—February to March.

6. *CALAMUS LEPTOSPADIIX*, Griff. in Calc. Journ. Nat. Hist. V, 49, Palms Brit. Ind. 60, t. CXCIV A.B.U.; Mart. Hist. Nat. Palm. III, 339.

t. 175, f. II, et t. ZXVIII, f. XIII; T. Anders. Journ. Linn. Soc. XI, 8; Gamble Man. Ind. Tim. 423; Hook. f. Fl. Brit. Ind. VI, 441; Becc. in Rec. Bot. Surv. Ind. II, 199, Ann. Bot. Gard. Calc. XI, 72, 142.

NAMES.—Lat (Lepcha), Dangri Bet (Nepal). Rani, Rabi Bet (Kurseong).

DESCRIPTION.—Scandent, forming tangled thickets; stems slender; foliage feathery. Leaves over 1 m. long. Leaflets numerous, approximate, regularly equidistant, linear-ensiform, 20-30 cm. long, 3-costate. Male and female spadices simply decompound and similar, long and slender. Partial inflorescences not many, very distant, strict, slender, 20-40 cm. long with 10-20 appressed spikelets on each side. Primary spathes very narrow, cylindrical, closely sheathing. Male spikelets scorpioid, 1-2 cm. long. Fr. globose or globose-ovoid, about 1 cm. in diameter (fig. 8).

HABITAT.—N.-E. India, Khasia Hills, Naga Hills, Sikkim.

Was found in flower and fruit in November.

Illustration : Plate CIII.

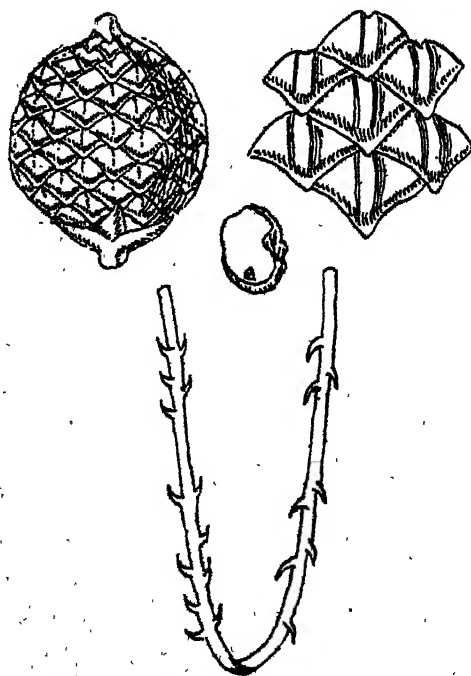


FIG. 8.—*Calamus leptospadix*.

Upper left: Fruit. Enlarged more than two diam.

Upper right: Scales of fruit. Magnified.

Central: Longitudinal section of seed (natural size).

Lower: Part of flagellum of female spadix. (After Griffith).



--- *Calamus leptosperma*, Griff. ---

7. *CALAMUS DILACERATUS*, Becc. in Rec. Bot. Surv. Ind. II, 198 : Ann. Roy. Bot. Gard. Calc. XI, 72, 144.

DESCRIPTION.—Tufted, probably not scandent. Female spadix erect, paniculate. Primary spathes short, membranous, dry, lacerate, armed with fine black spicules; secondary spathes tubular-infundibuliform, dry, thin in texture and much lacerate. Female spikelets with a pedicellar portion $1-1\frac{1}{2}$ cm. long. Fruiting perianth of 6 spreading, equal, lanceolate parts. Fr. small, ovate, 12 mm. long. Seed subglobose with an even surface.

HABITAT.—Nicobar Islands.

8. *CALAMUS PACHYSTEMONUS*, Thw. Enum. Pl. Zeyl. Addenda, 431; Hook. Fl. Brit. Ind. VI, 422; Becc. in Rec. Bot. Surv. Ind. II, 201; Ann. Roy. Bot. Gard. Calc. 74, 165.—*C. gracilis*, Thw. l. c. 330 (*non* Roxb.). Trimen Fl. Ceyl. IV, 333.

DESCRIPTION.—Stem slender, scandent; sheaths sparingly tubercled and armed with small flattened pale spines. Leaves 1-2 feet long, pinnate, upper bifoliate; petiole short, slender; rhachis armed with solitary, stout, recurved spines, rhachis about 3-7 inches long, not flagelliferous; leaflets 4-7, irregularly disposed, 5-12 inches long and $\frac{1}{2}$ - $2\frac{1}{2}$ inches broad, oval, subacute, or obtusely acuminate, 3-5-veined, margins and midrib beneath smooth, cross-venules distinct, upper pair sometimes connate with a spinous rhachis. Spathes funnel-shaped, truncate, cuspidate, armed with small prickles; spathells and spathellules cupular or patelliform. Spadix very long, slender, decompound, branches few, spikes many, alternate, $\frac{1}{4}$ - $\frac{1}{3}$ inch long, crowded, scorpoidly recurved. Male flowers in many series, $\frac{1}{8}$ inch long, linear, curved; calyx cupular, striate, lobes short, obtuse; petals twice as long, linear-oblong, acute, striate, connate in a column at the base; filaments thickened at the base, then subulate, tip not inflected. Fruit unknown.

HABITAT.—Ceylon. Moist low country below 1,000 feet, rare, Kukul, Korale, Kalutara, Galle.

FLOWERS.—In November and December.

9. *CALAMUS DIGITATUS*, Becc. in Hook. f. Fl. Brit. Ind. VI, 442; Becc. in Rec. Bot. Surv. Ind. II, 201; Ann. Roy. Bot. Gard. Calc. 74, 166.—*C. pachystemonus*, Thw. Enum. Pl. Zeyl. 431 (*partim*).

NAME.—Kukula-wel (Singh.).

DESCRIPTION.—Stem very slender, scandent; sheath not flagelliferous (?), copiously beset with long and short, strong, straight, flat spines and conical shorter ones, mouth with a rather large ochrea; petiole 6-8 inches long, slender; rhachis furfuraceous, unarmed, or with a few distant, recurved, large or small spines. Leaves digitately 2-4-foliate; leaflets 8-12 inches long and 1-3 inches broad, oblanceolate, cuspidately acuminate, 3-7-veined, base scurfy beneath, margins and veins smooth, upper pair

sometimes confluent with a spinous rhachis for half their length. Lower spathe elongate, cylindric, unarmed, upper very slender, mouth truncate, entire, spadix very long, slender, decompound, very sparingly spinous, branches distant; spikes very many, $\frac{1}{2}$ -1 inch long, spathelets short, patelliform, imbricate. Male flowers $\frac{1}{2}$ inch long; calyx tubular, striate, lobes short; petals twice as long or more, narrow, straight or falcately curved; connate at the base; filaments very short, conical, tip subulate, straight. Fr. seated on the slightly enlarged perianth, globose, $\frac{1}{3}$ inch in diameter, pale yellow; beak very small; scales 6-7 in a vertical series, very broad with scarious brown margins and an obscure channel in the middle; endosperm subruminate; embryo basilar.

HABITAT.—Ceylon. Moist low country below 1,000 feet, rather rare. Reigaur and Pasdun Korales, Hiniduma, Galle.—Endemic.

FLOWERS.—In March.

10. *CALAMUS RADIATUS*, Thw. Enum. Pl. Zeyl. Addenda, 431 (1864); Hooker f. Fl. Br. Ind. VI, 442; Trim. Fl. Ceyl. IV, 338; Becc. in Rec. Bot. Surv. Ind. II, 20; Ann. Roy. Bot. Gard. Calc. XI, 75, 168.

NAME.—Kukula-wel (Singh.).

Stem very slender, scandent; sheaths flagelliferous, densely armed with short acicular spines which are free or are connate below in transverse ridges mixed with long bristles, upper transversely rugose. Leaves radiately 6-8-foliolate; petiole 2-4 inches long; rhachis rather slender, bearing small scattered recurved spines. Leaflets 8-12 inches long and $\frac{3}{8}$ inch broad, linear acuminate, thin, 3-veined, midrib beneath and margins quite smooth. Spathes few, very long, clavately funnel-shaped, cuspidate. Spadix polygamo-dioecious, very long, slender, decompound, armed with small recurved spines; primary branches 2-6, 2-3 feet long; spikes $\frac{1}{2}$ - $\frac{3}{4}$ inch long, rather distant, reflexed, 3-15-flowered, naked. Spathes and spathelets cup-shaped. Male flowers: Calyx short, cylindric, striate; petals much longer, connate below in a short tube; filaments conical, tip subulate, straight; pistillode oblong, 3-fid. Female flowers $\frac{1}{10}$ inch long; calyx cupular, lobes broad, acute, striate; petals short, acute, striate. Fruit seated on the slightly enlarged perianth, globose, $\frac{1}{3}$ inch in diameter, shortly beaked; scales about 8 in a vertical series, broadly triangular, dull yellow with narrow red-brown entire margins, and an obscure median channel; endosperm ruminate; embryo basilar.

HABITAT.—Ceylon. Moist low country below 1,000 feet, rather common, Hiniduma, Hewesse, Kalutara.—Endemic.

FLOWERS.—In February and March.

(To be continued.)

THE RAPTORES OF THE PUNJAB.

BY

C. H. DONALD, F. Z. S.

(With 2 Plates.)

The writer has been asked, frequently, to write a small pamphlet dealing with the Birds of Prey of the Punjab, in simple language, and in such a way, if possible, as will save the layman from wading through pages of printed matter couched more or less in technical language, to arrive at the species of any particular specimen.

In a Province, rich in Raptores, it is strange how very little is really known about them and since even a scanty knowledge of the birds and beasts around one, materially enhance the joys of camp life, many more people would take up the subject, if it was possible to do so, without taking up too much of one's time.

The Birds of Prey lend themselves particularly in this respect and considering the total number of species in the Province is under three score, it is by no means a comprehensive subject, and I do not think it is an exaggeration to state that quite 60 per centum of them can be recognised high up in the air, and very nearly the same percentage could be identified by touch alone, blindfolded, from skins of normal specimens, with a little practice.

There are now numbers of books which make the study of our feathered friends a pleasure, but very few, unfortunately, do more than just touch on the Birds of Prey, and yet they amply repay a little trouble on their behalf.

In this paper, it is not the intention of the writer to go into minute details, and colouring will not be described at all, except in a very general way, or where some species displays some peculiar characteristic in that respect, which is also a constant feature.

Most Raptores change their entire dress from the nestling to the adult stage and hence colouration is a broken reed to depend on.

It will be seen from the keys appended that there are other and much more reliable factors than colouration to go on, for the identification of species.

From the keys here given, it will be possible not only to place any given specimen in its proper genus, by merely looking at its legs, head, beak and wings but in about 90 per cent. of cases, to also name its species. There are some half a dozen species which will need a closer study of their characteristics than will be found in this paper, but since the search will then only be confined to one of two species in each case, it reduces one's work to a minimum.

The actual details and measurements here given lay no claim to originality. They are all to be found in various books of reference,

with one or two additions which the writer has noted for himself, as rare exceptions, but the method of bringing out the characteristics of a genus or species, is, I believe, original, and if not on scientific lines, it at least lays claim to simplification of identification, which is the chief object of this paper.

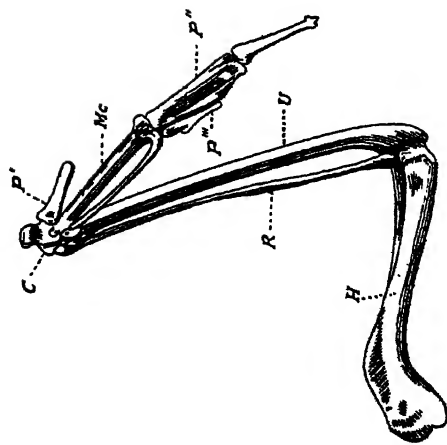
The details of the keys in most cases have been taken from Blanford's Fauna of British India, Vol. III., which cannot be improved upon and in the few instances in which the specimen to be identified is not discoverable by these keys, a further reference to the above mentioned Volume will dispel all doubt.

I have already said that the Birds of Prey are but little known, as a general rule, and to give but a couple of instances will suffice to show how easy it is to go wrong from descriptions, when colour is depended on too much. Not many years ago, the writer saw a very fine specimen of a Golden Eagle, in its first plumage, in an up-to-date museum marked "*Aquila heliaca*, the Imperial Eagle" and a legend beneath informed the visitor that "this bird sometimes catches chikor"!

On another occasion a Golden Eagle in its transition stage of plumage was the innocent cause of a controversy which lasted for several months, and the specimen was finally sent home for identification. The reason for this is not far to seek. In its first plumage, the Golden Eagle is marked very like an Imperial Eagle in its adult plumage. Both are a very deep brown, almost black generally, both have light brown or buff lanceolate feathers on the head and neck, both have a lot of white on the tail and a white patch in the centre of each wing and a large female Imperial would be very nearly as big as a small male Golden. But here the similarity ends. To any person acquainted with the habits of the two birds, they are as the Poles apart. One is a mighty hunter with a very large and powerful foot and claws, an easy graceful flight during which he holds his wings well above his back and shows a large expanse of chest, whereas the other is nothing more or less than as Mr. Hume has very aptly called him, a "great hulking kite".

He is no more capable of catching a chikor except a wounded or a tame bird, than is the Lammergeyer capable of pulling down an ibex or a "ghoorel", as he has been accredited with doing in all seriousness. One look at the comparatively weak foot and small talons precludes any such possibility. In flight the true Eagles, with the exception of the Golden Eagle, very much resemble the Vultures, except that they appear very much lighter on the wing and show a little more tail, protruding beyond the line of the wing.

As a rule when the Vultures are soaring, their wings appear to be broader than the Eagles and the tail when spread, as it frequently is, forms almost a continuous line with the edges of the wings. I say almost a line, as it is not exactly a continuous one and it looks



H = humerus
R = radius
U = ulna
C = carpus
Mc = metacarpus
P = thumb of the hand
P' = phalanges of the fingers
P'' =
P''' =

= arm bone in a human.
= fore arm
= wrist
= palm
=

The wing feathers.
always 11 in Birds of Prey, grow from the bones of the hand, i.e., on the finger joints and metacarpus.
shorter and softer than the primaries, arise from the fore arm, on the posterior side of the ulna.
grow from the end of the fore arm, nearest the body.

Primaries
Secondaries
Tertiaries

WING OF VULTURE.

THE RAPTORES OF THE PUNJAR.

as though a small piece had been cut out on either side, where the tail feathers touch the tertiary wing quills, and the tail itself projects just the least bit beyond the line of the wings.

I will endeavour to show the difference between the flights of the various genera later on in this paper. It is not too much to say that it is very often easier to identify a bird on the wing than it is, at a casual glance, in the hand.

The nomenclature in every case is the same as that given in the Fauna of Br. India (Blanford) but I have sub-divided the Families and Sub-Families into "Types" and have changed the sequence of the genera as given in the above book, to suit the purposes of my "Types."

To give an example as to how the keys are worked, let us imagine we have got a specimen of some large Raptores which we wish to identify. Look at the following points:—

- A. Has it got feathers on its head and neck or only down?
Feathers, well it cannot be a Vulture, so we can leave out of count Type "C."
- B. Examine next its legs; has it got a feathered tarsus, *i.e.*, does the feathering extend to the base of the toes, back and front? It does, so the specimen must come under Type "D," therefore it must be either a true Eagle, a Lammergeyer, or Hawk Eagle, but which? Next you look at the wing. Fold the wings against the body in the same way as the bird would naturally have them when sitting down and see if the longest primary quills reach to within an inch or less of the tip of the tail. You find they do and that the hind claw (without the toe) is the longest claw, so you straight away eliminate all the Hawk-Eagles and know that your specimen must be a true Eagle and belong to the genus *Aquila*.

You have thus got rid of 24 genera and some 50 species and have now only got 5 species to go through and that will be found as simple as arriving at the genus, and you proceed as follows:—

- A. Look at the nostril and see whether it is elliptical or ear-shaped and higher than broad, or if it is round and as broad as high. You find it to be distinctly elliptical and higher than it is broad, so it cannot be that of *A. maculata*.
- B. You next measure the length of its tarsus and find it to be just 4" so you know that it cannot be either an Imperial (*A. heliaca*) or a Tawny (*A. vindhiana*) and must be either a Golden (*A. chrysaetus*) or a Steppe Eagle (*A. bifasciata*).
- C. Having arrived at this conclusion you next look at its foot and claws. A huge foot, in which the claws are capable of meeting round your wrist, and the hind claw well over

2" in length, round the curve, dispels all further doubt and you know your specimen is undoubtedly a Golden Eagle.

After a very little practice it will not be necessary to go through the process of elimination and the specimen will be placed in its proper genus at the first glance. In the above example it will be seen that the specimen selected is of a Type that contained other genera with very similar characteristics, so we will try another and a simpler one.

A very large bird, with tarsi feathered and a *beard of stiff bristles* depending from the chin. Straight off you have the genus *Gypaëtus* and since there is only one species representing this genus, your specimen is *Gypaëtus barbatus*, the Lammergeyer.

By placing all the different genera with a common characteristic into one Type, it reduces one's search from some 55 to 14 species, by merely looking at the head, feet or beak, as the largest Type, viz. :—"G," has 14 species, whereas 3 have only one species each, and having found your Type you know exactly how many genera and species have been automatically eliminated and how many remain.

I now proceed to give the keys for, (a) the Types and (b) for the genera and species.

THE BIRDS OF PREY DIVIDED INTO "TYPES."

ORDER ACCIPITRES.

Families...	..	..	PANDIONIDÆ, VULTURIDÆ, FALCONIDÆ.
Sub Families	..	..	<i>Gypaëtinae</i> , <i>Falconinae</i> .
Types	..	..	A, B, C, D, E, F, G, H.

GENERA AND SPECIES.

Type A...	Genus	PANDION	Species	<i>P. haliaëtus</i> , The Osprey.
		VULTUR	"	<i>V. monachus</i> , The Cinereous Vulture.
		OTOGYPS	"	<i>O. calurus</i> , The Black Vulture.
				<i>G. fulvus</i> , The Griffon Vulture.
				<i>G. himalayensis</i> , The Himalayan Griffon.
		GYPS	"	<i>G. indicus</i> , The Indian Long-billed Vulture.
Type B...	Genera			<i>G. tenuirostris</i> , Himalayan Long-billed Vulture.
		PSAUDOGYPS	"	<i>P. bengalensis</i> , Indian White-backed Vulture.
				<i>N. ginginianus</i> , Smaller White scavenger Vulture.
		NEOPHON	"	<i>N. percnopterus</i> , Large White Scavenger Vulture.

Type C. . . Genus	GYPÆTUS	Species.	<i>G. barbatus</i> , The Lammer-geyer.
			<i>A. chrysaëtus</i> , The Golden Eagle.
			<i>A. heliaca</i> , The Imperial Eagle.
	AQUILA	"	<i>A. bifasciata</i> , The Steppe Eagle.
			<i>A. vindhiana</i> , The Tawny Eagle.
			<i>A. maculata</i> , The Large Spotted Eagle.
Type D. . . Genera			<i>H. fasciatus</i> , The Bonelli's Eagle.
	HIERÆTUS	"	<i>H. pennatus</i> , The Booted Eagle.
	ICTINÆTUS	"	<i>I. malayensis</i> , The Black Eagle.
			<i>S. himnaëtus</i> , The Changeable Hawk-Eagle.
	SPIZAÆTUS	"	<i>S. nepalensis</i> , Hodgson's Hawk-Eagle.
Type E. . . Genus	ARCHIBUTEO	"	<i>A. hemiptilopus</i> , Himalayan Rough-legged Buzzard.
	ELANUS	"	<i>E. caeruleus</i> , The Black-winged Kite.
			<i>M. govinda</i> , Common Pariah Kite.
	MILVUS	"	<i>M. melanotis</i> , The Large Indian Kite.
			<i>M. migrans</i> , The Black Kite.
Type F. . . Genera	HALIASTUR	"	<i>H. indus</i> , The Brahminy Kite.
	PERNIS	"	<i>P. cristatus</i> , The Crested Honey Buzzard.
			<i>B. ferox</i> , The Long-legged Buzzard.
			<i>B. leucocephalus</i> , The Upland Buzzard.
	BUTEO	"	<i>B. desertorum</i> , The Common Buzzard.
			<i>C. gallicus</i> , The Short-toed Eagle.
	CIRCAÆTUS	"	<i>S. cheela</i> , The Crested Serpent Eagle.
	SPILORNIS	"	<i>B. teesa</i> , The White-eyed Buzzard Eagle.
	BUTASTUR	"	<i>H. leucoryphus</i> , Pallas's Fishing Eagle.
Type G. . . Genera	HALIAÆTUS	"	<i>H. albicilla</i> , The White-tailed Sea Eagle.
			<i>P. ichthyæstus</i> , The Large Grey-headed Fishing Eagle.
	POLIOÆTUS	"	<i>P. humilis</i> , Hodgson's Fishing Eagle.
			<i>C. macrurus</i> , The Pale Harrier.
	CIRCUS	"	

Type G. . . Genera	CIRCUS	Species.	{ <i>C. cyaneus</i> , The Hen Harrier. <i>C. æruginosus</i> , The Marsh Harrier.
	ASTUR	"	{ <i>A. palumbarius</i> , The Goshawk. <i>A. badius</i> , The Shikra.
	ACCIPITER	"	{ <i>Ac. nisus</i> , The Sparrow-Hawk. <i>Ac. virgatus</i> , The Besra Sparrow-Hawk.
			{ <i>F. peregrinus</i> , The Peregrine Falcon. <i>F. peregrinator</i> , The Shahin Falcon. <i>F. barbarus</i> , The Barbary Falcon.
Type H. . . Genera	FALCO	"	{ <i>F. jugger</i> , The Laggar Falcon. <i>F. cherug</i> , The Saker Falcon. <i>F. milvipes</i> , The Shanghar Falcon. <i>F. subbuteo</i> , The Hobby. <i>F. severus</i> , The Indian Hobby.
	ÆSALON	"	{ <i>Æ. regulus</i> , The Merlin. <i>Æ. chicquera</i> , The Turumti or Red-headed Merlin.
	TINNUNCULUS	"	{ <i>T. alaudarius</i> , The Kestrel.

Key to the Types of *Raptores*.

Type.	Characteristics.
A. Size medium	a. Head feathered; b. tarsi naked; c. outer toe reversible; d. no aftershaft to contour feathers.
B. Size very large	a. Head feathered; b. tarsus feathered; c. beard of rough bristles depending from the chin.
C. Very large to medium	a. Head naked or covered with down; b. tarsus naked.
D. Do. do.	a. Head feathered; b. tarsus feathered to the toes back and front.
E. Large	a. Head feathered; b. tarsus feathered to the toes in front only, naked behind.
F. Medium to small	a. Head feathered; b. tarsi feathered, in front, for about half its length, or more, naked behind.
G. Large to small	a. Head feathered; b. tarsi feathered, in front, for less than half its length, or only at the base, naked behind.
H. Small	a. and b. As for F. (f.) a sharp pointed tooth on the cutting edge of the upper mandible.

Key to the Genera of the Raptores.

In the Key to the *Genera* of the Types, letters from a to r have been used to denote various peculiarities merely to save repetition.

Through this Key —

- a. refers to peculiarity of nostril
- b. " " " " tail
- c. " " " " neck
- d. " " " " primaries with reference to secondaries
- e. " " " " claws
- f. " " " " primaries with reference to tail
- g. " " " " crest
- h. " " " " tarsus

and so on. For instance, in the case of the genus *Hieraetus* in which the primaries exceed the secondaries by more than length of tarsus the claws are much curved, hind claw longest (as in the case of *Aquila*), instead of repeating the whole characteristic, I merely say "d and e as in *Aquila*" under which genus it has already been given.

The same letter, wherever it occurs, always applies to the same characteristic in the Key to the genera.

Type.	Genus.	Size.	Characteristics.
A.	PANDION	.. Medium	.. The same as for the Type.
B.	GYPÆTUS	.. Very large	.. The same as for the Type.
C.	VULTUR	.. "	.. a. Nostril round; b. tail of 12 feathers.
"	OTOGYPS	.. "	.. a. and b. As for <i>Vultur</i> ; c. fleshy wattle on each side of the neck.
"	GYPs	.. "	.. a. Nostril a narrow vertical slit; b. tail of 14 feathers.
"	PSEUDOGYPUS	.. "	.. a. As for <i>Gyps</i> ; b. tail of 12 feathers.
"	NEOPHRON	.. Medium	.. a. Nostril a narrow horizontal slit.
D.	AQUILA	.. Large to medium	d. Primaries exceeding secondaries by more than length of tarsus; e. claws much curved, hind claw longest; f. primaries reaching to the tip of tail in closed wing, or very nearly.
"	HIERÆTUS	.. "	.. d. and e. As for <i>Aquila</i> ; f. primaries not reaching to within a couple of inches of tip of tail.
"	ICTINÆTUS	.. Large	.. d. As for <i>Aquila</i> ; e. claws but little curved, inner longer than hind claw.
"	SPIZÆTUS	.. Medium	.. d. Primaries exceeding the secondaries by less than length of tarsus; e. as for <i>Aquila</i> ; f. primaries only reaching to just over half way down the tail in closed wing; g. an occipital crest present.

Type.	Genus.	Species.	Characteristics.
E.	ARCHIBUTEO	.. Large	.. The same as for the Type.
F.	ELANUS	.. Very small	.. h. Tarsus very short, under $1\frac{1}{2}$ " in length.
"	MILVUS	.. Medium	.. h. Tarsus over 2", scutellated in front, not behind; i. tail forked; j. colour dark brown.
"	HALIASTUR	.. "	.. h. As for <i>Milvus</i> ; i. tail rounded; j. colour in adults maroon above, white below.
"	BUTEO	.. "	.. h. Tarsus from 2.75" to 3.75" in length, with transverse shields behind.
"	PERNIS	.. "	.. k. Bill compressed and weak; l. lores and sides of head covered with small scale like feathers.
G.	HALIAETUS	.. Large	.. h. Tarsus with some scutellæ broader than high, over 4" in length; m. claws grooved beneath.
"	POLIOAETUS	.. Medium	.. h. As for <i>Haliaëtus</i> , but under 4"; m. claws rounded beneath, outer toe partially reversible.
"	CIRCAETUS	.. Large	.. h. Tarsus reticulated throughout, no scutellæ broader than high; n. no crest.
"	SPILORNIS	.. Medium	.. h. As for <i>Circaëtus</i> ; n. broad nuchal crest.
"	BUTASTUR	.. Small	.. h. Scales in front of tarsus larger than those behind, not scutellated behind. Those in front practically the same size from base of tarsus to near the base of mid-toe and not diminishing in size gradually. o. irides white in adults.
"	CIRCUS	.. Medium	.. h. Tarsus with transverse shields in front and smaller polygonal scales behind. The scales in front largest near the top end and diminishing in size lower down, where they become gradually absorbed in the reticulation near base of mid-toe. o. irides yellow or light brown.
"	ASTUR	.. Medium to small	h. Tarsus scutellated behind and in front: p. bill from gape $\frac{2}{3}$ rd to $\frac{1}{4}$ of mid-toe without claw.
"	ACCIPITER	.. Small	.. h. As for <i>Astur</i> ; p. bill from gape about $\frac{1}{2}$ mid-toe without claw.
H.	FALCO	.. Medium to small	q. 2nd quill longest, 1st much longer than 4th; i. tail rounded; r. upper plumage grey or brown.
"	ÆSALON	.. Small	.. q. 2nd and 3rd quills longest and subequal, 1st and 4th, also subequal.
"	TINNUNCULUS	..	.. i. Tail graduated, a difference of $1\frac{1}{2}$ " to 2" between the middle pair and outer tail feathers, a broad dark band on end of tail, the extreme tip white; r. upper plumage reddish.

Key to the Species of the Raptores.

Type.	Genus.	Species.	Characteristics.
A.	PANDION	.. <i>P. haliaëtus</i>	.. As for genus.
C.	GYPÆTUS	.. <i>G. barbatus</i>	.. As for genus.
	VULTUR	.. <i>V. monachus</i>	.. As for genus.
	OTOGYPS	.. <i>O. calvus</i>	.. As for genus.
	GYPs	.. <i>G. fulvus</i>	a. Larger, wing 27-31 inches; b. 3rd primary longest; lower plumage with narrow shaft stripes.
	"	.. <i>G. himalayensis</i>	a. As for <i>G. fulvus</i> ; b. 4th primary longest; lower plumage with broad shaft stripes.
B.	"	.. <i>G. indicus</i>	a. Smaller, wing 22-25.5"; b. crown of head with scattered hairs.
	"	.. <i>G. tenuirostris</i>	a. As for <i>G. indicus</i> ; b. crown of head naked.
	NEOPHRON	.. <i>N. ginginianus</i>	a. Bill yellow in adults; length about 24".
	"	.. <i>N. percnopterus</i>	a. Bill dark horny at all ages, length about 26 inches.
	AQUILA	.. <i>A. chrysaëtus</i>	a. Nostril elliptical, higher than broad; b. tarsus 4" in length; c. hind claw over 2½".
	"	.. <i>A. heliaca</i>	a. As for <i>A. chrysaëtus</i> ; b. tarsus under 4"—3.5" to 3-85".
	"	.. <i>A. bifasciata</i>	a. and b. As for <i>A. chrysaëtus</i> ; c. hind claw well under 2".
	"	.. <i>A. vindhiana</i>	a. As for <i>A. chrysaëtus</i> ; b. tarsus 2-75" to 3-25".
	"	.. <i>A. maculata</i>	a. Nostril round, as broad as high.
D.	HIERÆTUS	.. <i>H. fasciatus</i>	a. Much larger, wing 19-21".
	"	.. <i>H. pennatus</i>	a. Smaller, wing 14-16½".
	ICTINAËTUS	.. <i>I. malayensis</i>	.. As for genus.
	SPIZÆTUS	.. <i>S. himaëtus</i>	a. Feathering of tarsus does not extend to division of toes; b. crest rudimentary.
	"	.. <i>S. nepalensis</i>	a. Feathering of tarsus extends to basal portion of mid-toe; b. crest 3" to 4".
	ARCHIBUTEO	.. <i>A. hemiptilopus</i>	.. As for genus.
E.	ELANUS	.. <i>E. caeruleus</i>	.. As for genus.
	MILVUS	.. <i>M. govinda</i>	a. Head tawny or rufous with black streaks in adults; b. length 24" or under.
	"	.. <i>M. melanotis</i>	a. As for <i>M. govinda</i> ; b. length about 25" or over.
	"	.. <i>M. migrans</i> (rare)	a. Head whitish with black streaks; b. length about 23".
F.	HALIASTUR	.. <i>H. indus</i>	.. As for genus.
	PERNIS	.. <i>P. cristatus</i>	.. As for genus.
	BUTEO	.. <i>B. ferox</i>	a. Wing over 16"; b. tarsus half feathered, naked part in front scutellate.

Type.	Genus.	Species.	Characteristics.
F.	BUTEO	.. <i>B. leucocephalus</i>	a. Wing over 16"; b. tarsus 2/3rd feathered, naked part in front reticulated.
	"	.. <i>B. desertorum</i>	a. Wing under 16".
	CIRCETUS	.. <i>C. gallicus</i>	As for genus.
	SPILORNIS	.. <i>S. cheela</i>	As for genus.
	BUTASTUR	.. <i>B. teesa</i>	As for genus.
	HALIAETUS	.. <i>H. leucoryphus</i>	a. Tarsus 4"-4.2"; b. tail about 12", rounded, the outer feathers not much shorter than middle pair, white band across it, about 3" from the end; c. feet dirty white.
	"	.. <i>H. albicilla</i>	a. Tarsus 4.5"; b. tail about 13", wedge shaped, middle feathers considerably longer than the outer pair, white except at the extreme tip; c. feet yellow.
G.	POLIOAETUS	.. <i>P. ichthyaetus</i>	a. Basal $\frac{3}{4}$ of all tail feathers white, in adults, mottled in young; b. length about 27"-29", tarsus 3.7."
	"	.. <i>P. humilis</i>	a. Middle tail feathers brown throughout; b. length about 25", tarsus 3."
	CIRCUS	.. <i>C. macrurus</i>	a. Outer web of 2nd, 3rd and 4th primaries notched but not of 5th; b. wing 14 $\frac{1}{2}$ "; tarsus under 3".
	"	.. <i>C. cyaneus</i>	a. Outer web of 5th quill notched; wing under 15", tarsus about 3"
	"	.. <i>C. aeruginosus</i>	a. b. Wing over 16" and tarsus 3 $\frac{1}{2}$ ", about.
	ASTUR	.. <i>A. palumbarius</i>	a. Size large, wing 12" to 15".
	"	.. <i>A. badius</i>	a. Size small, wing 7" to 9".
ACCIPITER	.. <i>A. nisus</i>	a. No gular stripe, 5 or 6 dark bars, one terminal, on 4th quill in adults.	
	"	.. <i>A. virgatus</i>	a. Generally a dark gular stripe; 7 or 8 bars on 4th quill in adults.
	FALCO	.. <i>F. peregrinus</i>	a. Length 16" to 19"; b. 1st primary longer than the 3rd; c. cheek stripe broader than the eye, no nuchal collar; d. crown dark grey, breast very slightly rufous.
	"	.. <i>F. peregrinator</i>	a. Length 15" to 18"; b. and c. as for above; d. crown blackish, breast generally deep rufous.
H.	"	.. <i>F. barbarus</i>	a. Length 15" to 17"; b. as for above; c. cheek stripe narrow, a buff nuchal collar, head ashy grey or rufous.

Type.	Genus.	Species.	Characteristics.
H.	FALCO.	.. <i>F. jugger</i> .	.. a. 16" to 18" length ; b. 1st primary subequal to 3rd or shorter; adults not banded above ; c. A distinct narrow cheek-stripe, middle tail feathers entirely brown in adults.
	"	.. <i>F. cherrug</i>	.. a. Length 19.5" to 22" ; b. as in <i>F. jugger</i> ; c. no cheek-stripe, middle tail feathers usually brown, with white spots on both webs.
	"	.. <i>F. milvipes</i>	.. a. Length 20" to 23" ; b. as for <i>F. jugger</i> , adults banded with rufous on back, wings and tail.
	"	.. <i>F. subbuteo</i>	.. a. Smaller, length under 13" ; breast white or buff with brown streaks.
	"	.. <i>F. severus</i>	.. a. As for <i>F. subbuteo</i> ; d. breast deep rufous, spotted in adults.
	ÆSALON	.. <i>A. regulus</i>	.. a. Crown grey or brown dark-shafted.
	"	.. <i>A. chiquera</i>	.. a. Crown chestnut.
	TINNUNCULUS.	.. <i>T. alaudarius</i>	.. As for genus.

How to know the Raptores on the Wing.

As I have already stated, most of the Birds of Prey can be as easily recognised on the wing, at a long distance off, as they can from specimens in the hand, but it is not so easy to describe what one can see for one's self, and in many cases, the difference is so very slight that it would be impossible to put it into words. I will not attempt to describe the very subtle distinctions between some species of the same genus, but they are there all the same and to a man who is accustomed to watching birds on the wing, they are plain enough.

I had an old falconer who could differentiate at a glance between the various falcons and between the male of a sparrow-hawk and a female Shikra. I was very sceptical at first as I could not see any difference between the two, until I went out of my way to catch the hawk regarding which I was doubtful, two or three times, and found him right every time. This degree of efficiency can only be acquired by long practice, and most men will be more than satisfied if they can get the length of recognising the majority of birds one comes across during a day's ramble, or see circling round their station.

Though colouration has played a very small part hitherto in this paper, it will be much more prominent now and will considerably aid the beginner in his search, though it is by no means always reliable.

For instance, in describing an adult Imperial Eagle on the wing, the predominating colour to look for is black, whereas the same bird in its first year plumage would be very like a Steppe Eagle and the predominating colour would be brown. If very near, the marking on the breast would serve as a clue, as the young Imperial has a spotted breast, whereas the Steppe would have a plain brown one. The Steppe again can generally be identified by having two buff or whitish lines running parallel to each other, which extend the whole length of his wing, which are lacking in the Imperial. Then again, the Tawny sometimes has one very distinct line

and very occasionally a second, similar to the Steppe, which makes it rather confusing, but these are rare exceptions and as a general rule, identification is a fairly simple matter.

I will first take the very large birds according to the predominating colours and endeavour to show the difference between them though the colouring is similar.

Very large birds in which black is the predominating colour.

1. *Ototype calvus*, Black Vulture.
2. *Aquila chrysaetus*, Golden Eagle.
3. *Aquila heliaca*, Imperial Eagle.
4. *Aquila maculata*, Large Spotted Eagle.
5. *Ictinaetus malayensis*, Black Eagle.
6. *Haliaetus leucoryphus*, Pallas's Fishing Eagle.
7. *Haliaetus albicilla*, White-tailed Sea Eagle.

The Black Vulture, like all vultures (except *Neophron*) has a very heavy flight, but unlike the others, he will be found to soar with his wings held well back, more like a hunting Eagle than a Vulture. To explain what I mean by wings being "held well back." If a straight pole was placed across the back of a bird in flight, from the tip of one wing to the tip of the other, it would be found that the back of the bird would lie some inches below the centre of the stick, and the bird thus appears to show a great expanse of chest. In most big birds the tips of the primaries have an upward tilt, when soaring, particularly in a strong wind, and light can be seen between the first few quills, i.e., they do not touch each other near the tips. The Hunting Eagles and the Black Vulture, however, do not rest content with tilting up their primaries only, but the entire wing, from the body, curves off at a distinct angle, upwards. The above will explain what I mean when I again refer to the wings being held well back.

In the Black Vulture, the tail projects only a very little beyond the line of the wings, the actual extent depending on whether the bird has got it spread out like a fan, or not.

Colouration.—More or less a deep black, with a line of whitish running down the centre of the whole wing. A white spot on the crop and another on each thigh, make this bird unmistakable. If near enough, red skin will be seen near the white patches above mentioned, and possibly the red wattles on his neck.

Aquila chrysaetus.—Wings curve back very considerably. The tail projects a long way beyond the line of the wings. In an old bird, practically no marking will be seen unless very near, when it will be noticed that the head is a light brown, or at least lighter than the rest of the bird and the middle of the tail may show traces of whitish. In a young bird the head and nape are much lighter than the body and a very conspicuous white patch in the centre of each wing, and a white bar on the tail, can be seen a long way off. This Eagle (the Golden) will not be found on the plains and except in the winter, seldom descends below 7,000 ft. Not at all likely to be found near any station in the hills.

Aquila heliaca.—Flight heavy; wings held in a line with the body. Tail projects beyond the line of the wings only a little more than in the case of a Vulture. Marking very similar to that of a young Golden Eagle except that the head and nape are much more conspicuous, there being much more white about the head than in the young Golden.

The plumage of the young Imperial is entirely different, and will be described later, among birds in which brown predominates.

Aquila maculata.—Smaller than any of the foregoing. Flight very like the preceding species but not so heavy. No distinctive markings of any



1.

THE RAPTORES OF THE PUNJAB.

1. A Steppe Eagle (*Aquila bifasciata*). Primaries in closed wing reaching tip of tail.
2. A Bonelli's Eagle (*Hieraaetus fasciatus*). The primaries in closed wing do not reach to within 2 or 3 inches of tip of tail.
3. A Laggar Falcon (*Falco jugger*). Long and pointed wings.
4. A Shikra (*Astur badius*). Wings very short.

sort, but sometimes minute patches of white may be seen on the body or wings, being the white basis of feathers showing through.

Ichneutes malayensis.—Flight closely resembles that of *A. chrysaetus* and the wings are held well back. Tail also projects well beyond the line of wings. No markings of any sort and the whole bird appears jet black when flying past. If near, a small patch of brilliant yellow may be seen in the lower portion of the body due to his feet showing.

Haliaetus leucoryphus.—Very like *A. heliaca* on the wing, but greatly given to flapping. Wings in line with body and as a rule, even the tips of the primaries do not curve upwards. When soaring, shows much more white about the tail than does *A. heliaca*. Extremely noisy. Tail projects a little more than in *A. heliaca*, a broad terminal edge of black on tail.

Haliaetus albicilla.—Very similar to the preceding species, except that the whole tail appears to be pure white and the broad terminal band of black which is seen in *H. leucoryphus* is wanting. At a very close range a very narrow edging of black on the tip of the tail may be seen.

Dark Brown Birds of Large Size.

Vultur monachus.—Size very large; wings appear to be very broad, held in a line with the body and the tail projects only a little beyond the line of the wings, usually spread out like a fan, when the bird is soaring. Colour a very deep chocolate brown throughout.

Gypaetus barbatus, immature plumage.—Size very large. Wings long and comparatively narrow, much more pointed than in the Vultures. Tail long and wedge-shaped. Colouring very variable; very dark brown, almost black about the head and neck shading to a somewhat lighter shade on the body and under portion of the wings. Frequently with irregular patches of white, buff or lighter shades of brown, showing on the body and wings. Back and tail usually a dark greyish brown.

Flight easy and graceful, wings held in a line with the body.

The young of—

A. heliaca may all be found in a very deep brown plumage, but
A. bifasciata seldom of a uniform shade throughout. Lighter and
A. vindhiana darker feathers will be found irregularly dotted about
in various portions of the body and wings. *A. heliaca* and *A. bifasciata* are
much bigger than *A. vindhiana* and *A. bifasciata*, even in immature
plumage, can be identified by two narrow parallel lines of buff or white
running along the whole length of the wings.

Archibuteo hemiptilopus

Buteo ferox

Buteo leucophelus

Buteo desertorum

All the Buzzards may appear in a very dark plumage, but will almost always display a lighter patch in the centre of each wing, and regular markings of a lighter brown on the wings and tail. Not much given to soaring, but when they do soar, the flight is easy, bold and graceful. The wings are held slightly back but do not curve upwards nearly so much as in *A. chrysaetus*.

Milvus govinda

„ *melanotis*

„ *migrans*

All dark brown throughout, with sometimes irregular markings of whitish buff or light brown. In *M. melanotis* there is a big buff wing patch, which is also visible to a lesser degree in *M. govinda*. All the kites can be identified by their forked tails. Flight is easy and light but irregular and frequently changing direction as though the bird is uncertain as to which line it should take. The wings are held in the same plane as the body and are frequently slightly bent as though the bird was meditating a stoop.

Spilornis cheela.—The Crested Serpent Eagle is a very deep chocolate brown with numerous whitish bars on the wings and tail. If at close quarters it will be seen that the whole body and the lining of the wing is covered with small white "ocelli." When scaring the wings are held well back, but are broad in proportion to his size, hence the tail does not project very far beyond the tertiaries. This is a noisy bird and gives vent to a shrill succession of whistles when on the wing. Found in the lower hills among Chir pine (*P. longifolia*) and oak (*Q. dilitata*) up to about 6,000 feet and is often found in the vicinity of paddy fields and streams. Little bigger than a kite.

Circus aeruginosus (female).—Not unlike a kite except that the tail is rounded and not forked. Usually a darker and more uniform brown, with a buff head and nape. Wings usually held in a line with the body but sometimes they curve up a little. Seldom bent, as in kites, and much given to flapping. Usually found over water. A little smaller than a kite.

Light Brown Birds with Markings.

The true Eagles of the genus *Aquila*, i.e., the Imperial, the Steppe and the Tawny Eagles as I have already shown may be either dark brown or come under the present category of light brown birds, and the Steppe may even be so dark as to look black, but in his case the ubiquitous white stripes are always present in a greater or lesser degree.

There is no necessity to describe the flight of each species over again and suffice it to say that the true Eagles can always be separated from the Vultures in having somewhat narrower wings in proportion to their size, and the tail projecting, even when spread out, a little more than in the case of the Vultures. The flight is lighter, i.e., the bird appears to be carrying less weight. If you watch a Vulture carefully, it will be seen that once he has got into his stride, as it were, there is no wavering about the flight and he circles in perfect curves, the wings being stretched to their full and perfectly still.

With the Eagles, on the other hand, there is more wing motion and the circle is not so true as in a Vulture.

The wings, too, are frequently seen to be slightly moving near the tips. One minute the primaries curl upwards and the next are slightly depressed, as though the air currents played tricks with their lesser weight and they had to meet each change with a slight movement of the wing.

Among the birds of the size of a Kite or larger, in which light brown predominates are the *Hieraëti* and the *Spizaëti*, both genera of hunting Eagles, which, with one exception, hold their wings very far back. The exception is *H. pennatus* which is particularly Kite-like in its flight.

The other species of the same genus, *Hieraëtus fasciatus*, the Bonelli's Eagle, is a grand bird on the wing and looks like a miniature of the Golden Eagle, except for the colouring.

Hieraëtus fasciatus.—A young bird is rufous underneath with grey brown wings and tail, whereas in his adult plumage the rufous on the body gives place to white, finely mottled with brown. The older the bird the more white is his body, the wings varying from light grey-brown to dark grey brown and to black on the tips of the primaries. Nearly always seen in pairs, either beating over grassy hillsides or soaring over a station in quest of pigeons.

Hieraëtus pennatus.—As unlike the preceding species, in flight, as it is possible to have them. Very much smaller in size (being the smallest of all Eagles with feathered tails). One phase of plumage of this species is a light to dark brown generally, with irregular lighter and darker patches and mottling on wings and body. Flight light and easy but not exactly

bold or graceful. Wings held level with the body and often, like a Kite's, the tips of the primaries appear to be on a lower level than the body, and bent from the wrist, backwards and downwards. The usual plumage is not unlike "*Neophron*", i.e., a dirty white throughout the underparts, with a black marginal band running along the tips of the wings, about 4" or so wide. The back is a mixture of dark brown and black as also the upper portions of the wings. Tail projects well beyond the tertiary quills.

Spizaetus limnaetus
Spizaetus nepalensis

Unmistakable in flight. Wings very short and round, held very far back and the tail projecting far beyond the line of wings. The underparts may

be a uniform light brown or, in old birds, the breast may be almost as white as in *H. fasciatus*, but more mottled with dark brown spots. Soars well and is often seen to give several short sharp flaps after a bout of circling on steady pinions. Size about that of a Kite. Usually found over heavy pine or oak forests.

Circætus gallicus.—A very light silvery brown throughout, almost a greyish white sometimes. Soars well. Wings held slightly back, the tips curled well up. If seen near, a dark streak will be noticed near the chin and another black line near the extreme end of the wing. Generally found over grassy plains and is one of the five Birds of Prey which hover. At close quarters his breast will be seen to be pure white, closely barred and mottled with brown. Upper parts dark grey.

VULTURES.

Gyps fulvus
Gyps himalayensis

Large birds, black and white or dark-grey and white. Very large birds with a true Vulturine flight. Colouring, chiefly a dirty creamy white throughout with a deep band of black along the edge of the wings. Young birds vary.

Gyps indicus
Gyps tenuirostris
Pseudogyps bengalensis

Smaller than the above with a similar flight. Predominating colour black or a very dark grey with a line of white on the wings. In many cases the wings appear to be half black and the other half white, mixed with grey.

The last species displays a great deal of white on the back, as he turns.

Polioætus ichthyaetus
Polioætus humilis

These Fishing Eagles are not given to soaring and are usually to be found sitting on trees overlooking some mountain, river or stream, or flying up and down it. The flight is rapid and the beats of the wing sharp and full. Colouring a deep grey on the back. Light grey on the head and neck and upper breast, fading to white on the abdomen.

Pandion haliaetus.—The Osprey is not often found soaring high in the heavens, though he might easily be seen circling over a tank or jheel. Underparts white with brown streaks and mottlings. Wings and back dark grey or brown, quills blackish. Wings held in a line with the body, often slightly bent from the wrist backwards and downwards. Much given to hovering and dropping head first, like a Kingfisher, right under water, whence he will emerge and almost invariably shake himself as he rises out of the water.

This disposes of most of the bigger birds and leaves the Falcons, Hawks and Harriers and the little Black Winged Kite.

Elanus caeruleus.—About the size of a pigeon, but with longer wings. Colour black and white. Underparts of the body and half the wings white. The quills black and the upperparts a very dark-grey to black. Flight jerky, with long full beats of the wings. Not given to soaring but a past master in the art of hovering. Found over scrub jungle as a rule.

THE TRUE HAWKS.

*Astur palumbarius**Astur badius**Accipiter nisus**Accipiter virgatus*

The first named is easily identified by his greater size, so far as the female is concerned.

All the Hawks have very short rounded wings and long tails in comparison to their size. All soar well but do not keep up circling like the Eagles. After attaining a good height they will be seen to go off in some particular direction and then suddenly close their wings and drop straight down, either after birds or merely into a tree.

In the course of circling they will be often seen to give a few short rapid beats of their wings and then continue circling.

Falcons.—Are the antithesis of Hawks. They have long pointed, swallow like wings and shorter tails and may be identified as such at any height. They all soar well. When soaring the wings are held straight and on the same plane as the body, but when flapping, the wings are usually bent as though preparing for a stoop.

Of the falcons, the Laggar is perhaps the commonest and the most easily identified, in the case of an old bird, on account of the white breast and the white marking on the wing lining. They usually hunt in pairs. While the identification of the Falcons is by no means difficult in most cases, to describe the subtle differences between each is, I am afraid, beyond my power.

Merlins.—These little birds seldom or never soar. The "Turumti" nearly always hunt in pairs and may be seen flying very low along the ground at an incredible speed, when their keen eyes have detected small birds feeding on some open "maidan," or over the tops of the trees, never very high up. Their little grey wings work at a tremendous pace and the white body is a certain guide.

The Merlin (*A. regulus*) does not hunt in pairs and is much darker in colour. It generally flies very fast with sharp short beats, with half closed wings.

Butastur teesa.—The flight of this bird is not unlike that of a true Hawk, except that his wings are longer and more pointed, though not nearly as long or pointed as that of a Falcon's. Given to soaring a great deal in the spring. From below has the appearance of being silvery white. The flap is slower and more deliberate than that of a Hawk. Talks a lot when he is soaring. A not unmusical 3 note call which sounds something like "whityu-whyu." Usually displays a very light buff patch on the nape. Dark grey above and light grey beneath. Breast much mottled. The Honey-Buzzard (*Pernis cristatus*) very much resembles the Goshawk in flight, except that it is a good deal bigger. Generally found in gardens and groves or along Canal banks. Flies rapidly and hurriedly from one tree to another and usually pursued by crows, mynahs, king crows, &c. Does not often soar but is occasionally found high up during the spring.

Birds in which White or Light Colours predominate.

Gypaetus barbatus.—The Lammergeyer in adult plumage is unmistakable. I have already said with reference to the young bird that his long narrow wings and the wedge-shaped long tail are sufficient to proclaim him at almost any height, and when, added to that you have a bright golden, head, neck and body with grey wings and back, he is hard to mistake for anything else. This bird is often seen flying low along a hill side with very bent wings, and in that condition they appear exceedingly pointed.

The Harriers.—I have already described the female of the Marsh Harrier. The males of the Hen Harrier and the Pale Harrier, in adult plumage, look pure white below, with a line of black running along the edge of

the wings. The upper parts, when seen vary from light grey to almost black. The male of the Marsh Harrier in adult plumage is rufous about the breast and body generally and there is a lot of light blue-grey about the wings, the tips being black. The hens of the two first mentioned are a light brown throughout, profusely speckled and spotted along the underparts, the brown being darker and more uniform above. A light buff collar is frequently visible as the bird flies past. A patch of white is visible on the lower portion of the back, near the root of the tail, which is much more pronounced in the Hen Harrier than it is in the other species. These birds do not often soar, except in the Himalayas, on their way to and from the plains, and are usually found beating over low scrub or grassy plains, with strong steady beat of the wings and checking every now and again to drop silently into a bush after some small bird.

The Buzzards.—I have already described the Buzzards in their melanistic phase of dress but they as frequently appear in a plumage which varies from light rufous brown to pure white on the head, neck and breast. It is impossible to describe the plumage of this genus here, as it varies from the one in which dark brown predominates to the very light rufous in which white plays an important part, even if it does not predominate and various phases between these two extremes are by no means uncommon.

Neophron.—The Scavenger Vultures vary, if anything, even more than the Buzzards. From the dark brown of the immature plumage to the pure white (usually a dirty white), with black margins to the wings, of the adult plumage. The flight of the Scavenger Vultures is not unlike that of *Gypætus barbatus*, both having long narrow wings and a wedge-shaped tail, but the latter is, of course, more than twice the size. Wings are held in a level with the body, and the flight is light, easy and graceful and the bird, in the air, cuts a very different figure to the ungainly, untidy bird one is accustomed to see on the ground.

When once the flight has been mastered it is extraordinary how very simple identification becomes, even in abnormal specimens. Take for instance a Kite without a tail, a common enough sight, yet there is no mistaking it for what it is, in spite of the fact that a forked tail is its chief characteristic.

I have been told on more than one occasion, that to know a Kite is simple enough, but a Kite will not go far to help one to recognise other species. The Kite will not help you but familiarity will. Everybody is familiar with the deportment of a Kite and can recognise it under any circumstances, simply because it is almost impossible to go out of a house without seeing one and the average person, unwittingly, takes in the various tricks of its flight and becomes gradually familiar with them. The same is possible with all other species, once a beginning is made and one has got into the way of watching for the characteristics.

From the above it must not be presumed that a mistake is impossible, but given normal specimens, I do maintain that in 80 per cent. of cases it is fairly easy to arrive at the correct conclusion with a little practice.

N. B.—Mr. Hume in "Rough Notes" gives some very interesting measurements of the wings of Eagles from which it will be seen that in some specimens the tip of the primaries in the closed wing fall short of the tip of the tail by as much as $2\frac{1}{2}$ inches. This might possibly be the case in certain individuals but these must be treated as rare exceptions. In a specimen in which the tail has moulted and attained its full length before the primaries for instance, but as a general rule the wings of the true Eagles will not fall short of the tip of the tail by more than an inch or so, whereas in the case of the Hawk-Eagles $2\frac{1}{2}$ " will be the minimum and as a rule a good

deal more. The genus *Hieraetus* though more of a Hawk-Eagle than a true Eagle, has longer wings than the *Spizaeti* and his method of hunting is essentially that of a long-winged Eagle or Falcon, *i.e.*, in the open and not among trees.

2. The measurements of the tarsi of the Imperial Eagle (Hume's "imperialis") is given by Mr. Hume in his above work as varying from 3.75" to 4.06" but it must be remembered that Mr. Hume has ignored the Steppe Eagle as a species and has treated it (*A. bifasciata*), as merely a phase of the Imperial in its transition stage of plumage, and hence his measurements of the tarsi of the Imperial, include those of the Steppe, as well. In its lineated or immature plumage the Imperial bears a close resemblance to the Steppe but whereas the Steppe is never mottled on the breast and is always a more or less uniform shade of brown, the young Imperial has the feathers of the breast brown with whitish shaft stripes.

That is, the centre of each feather is lighter than the rest of it, giving it a distinctly mottled appearance. Whereas the tarsus of the Imperial is shorter than that of the Steppe, the foot and claws are bigger.

3. Occasionally a specimen may be met with which will be difficult to identify as either a Steppe or a Tawny, and bearing a very close resemblance to both. That the species occasionally interbreed is, I think, possible and I can give two instances which make me think they do, but as neither case proves anything definitely we must wait for further instances and more conclusive proof before accepting the theory.

On one occasion I saw an undoubted female Steppe Eagle carrying sticks to a nest off which I had caught a male Tawny only an hour or two previously. On yet another I shot what I took for a Tawny, very high up in the Himalayas, just about the time when the Steppe Eagles would be finding their way down to Northern India (in the autumn). This specimen had undergone a complete moult, with the exception of a few back and head feathers, and yet did not show a single trace of the white wing stripes. The tips of the secondaries and the feathers of the wing underlining were a rich brown like the rest of the wing. The size too was that of a Tawny and yet the tarsus measured just over 4" and the fact of the bird being found so far up in the hills pointed to it being a Steppe. The tarsus is, however, a sure indication between these two species so long as the type is true to the species and abnormal specimens or possible hybrids need not be taken into count.

ON THE DETERMINATION OF AGE IN BATS.

BY

KNUD ANDERSEN, F.Z.S.

(With a plate.)

The question was once put to me by a fellow zoologist: "What is the possible age of one of our small insectivorous bats, supposing it is allowed to live its normal span of years without accidents of any kind?" I had to confess that we knew practically nothing about it. Insectivorous bats, any species, are extremely difficult to keep alive in captivity, and Horseshoe-Bats are among the most intractable of all; I am not aware that any species of these latter has been kept in confinement for more than a few weeks. But even if this were otherwise, the length of its life in captivity would of course, give us no reliable information of the age the individual might reach under the totally different conditions of Nature, though it might in the most favourable cases give us an idea of the lowest possible age of the individual under natural conditions. There is another way to approach the problem, so long as we have no better facts to judge from. The length of the period of immaturity will, as a general rule, in some vague sort of way enable us to form an opinion of the normal age the individual is destined to obtain; a mammal which quickly becomes full grown will probably have a rather short series of years to live as adult, and *vice versa*. There may be hundreds of exceptions from this rule among lower vertebrates, but I doubt that there are many among mammals. Insectivorous bats have only a short period of immaturity, species of the size of the Rufous Horseshoe-Bat of India (*Rhinolophus rouxi*) hardly more than about six months (I am speaking of the period of growth, not of the time required for sexual maturity, of which we know but little in the case of most bats), and their life-time may therefore be supposed not to be very long. A more definite answer it has, to my knowledge, till now not been possible to give.

Although I do not deny that it might be interesting to be able to answer the question just referred to, there is another problem, closely connected with this, and which in my opinion is of more practical importance. It is this. If an insectivorous bat is placed in our hands, have we then any means by which to determine its age? The question may be answered both ways. It is easy enough to decide whether it is immature or adult (by examining the epiphyses at the distal ends of the metacarpals, which can be done by simple exterior inspection, without injuring the individual). Supposing it to be adult, it is again easy enough to tell, by the degree of wear of its teeth, whether it is a youngish adult, a middle

aged, or an aged individual. But when it comes to the question of months or years, we must give it up.

I consider this question, as to the actual age of a given individual, for practical purposes more important than the question of its possible extreme span of life (but the solution of the former will, of course, ultimately lead to the solution of the latter, as we shall see later on). To give one instance among many. Certain Horseshoe-bats show a truly bewildering "variability" in the colour of their fur, and the Indian *Rhinolophus rouxi* is in this respect one of the most perplexing of all. Have these colour "variations" anything to do with the sex or season (these questions it ought to be possible to settle at once by reference to the labels of the specimens) or with the age of the individuals? I have had to attack this problem lately, when working out for the British Museum "Catalogue of Chiroptera" the unusually fine series of *Rh. rouxi* collected by Mr. Guy C. Shortridge for the Bombay Natural History Society's Mammal Survey of India,* and it has naturally induced me to study more closely the different stages of wear of the teeth, with the object of finding in them a possible means to determine the age of each individual. This paper gives my conclusions.

A few words to explain my method. To eliminate, as far as possible, all sources of error, should be our first consideration. An ideal material would therefore be this:—We require, as a basis, to begin with, a series of specimens all collected approximately on one day or at least within the space of about a month, and showing all stages of wear of the teeth; provided they really show all degrees of wear found on that date or in that month, we shall be able to sort them out in so and so many stages, separated by one year. In many cases we should require an enormous series of individuals in order to have all stages represented, in others, with more good luck, a much smaller series will contain all the stages. Further, this series ought to be collected, if not exactly on the same spot, at least within the same faunistic area, to make reasonably sure that differences in food have not influenced the degree of wear of the teeth. If we have succeeded so far, we still require any amount of material of the same species from every other month of the year (but preferably from the same area), in order to check the results we obtained by our first series.

It would be too much to say that the Shortridge material fulfils, absolutely, these ideal conditions, but it comes sufficiently close to them to be workable. It contains forty individuals, not from one month, but from two consecutive months, viz., October and November, all from the same district, and I have reason to believe that

* See my paper "On the so-called colour phases of the Rufous Horseshoe-bat of India" (*Rhinolophus rouxi*, Temm.), this Journal, *infra*.

they show all stages of wear, possibly (not certainly) with exception of an extreme senile stage. It has further the advantage of being from October and November, thus containing a good number of individuals just adult (supposing the young of this species, in that particular region of India, to be born in April or May, which, judging from the foetuses I have seen, they probably are, as a rule), showing the first stage of wear, that of adult specimens about six months old. It further contains sixty-four adult specimens from the same zoogeographical area, not from the ten other months of the year, but from four (January, February, April and May), sufficiently distant to check the results derived from the October-November series.

Those not familiar with the molar structure of a *Rhinolophus* should examine fig. B, on the plate accompanying this paper, and the explanation of that figure on p. 258, before proceeding to read the next paragraph.

The different stages of wear of the anterior upper molar in October-November individuals.

First stage (fig. I).—The molars in this stage are so little worn that it requires some care, and often the use of a good pocket lens (or better still, a dermatoscope), to discover the traces of wear. The commissures (1-4, 2-5, and 3-5; see fig. B) are no longer absolutely sharp-edged, as in the perfectly unworn tooth; that is, they show, not one single line (like a razor edge), but distinctly two sub-parallel lines very close together, and between these lines an exceedingly narrow sublinear flattened edge. Similarly, the ridge of cusp 6 is not single-edged, but shows two more or less parallel lines; its central portion is always a little more worn than the ridge in front of and behind it, because it, being the highest point of the ridge, is more energetically acted upon by the corresponding tooth of the lower jaw (cusp 5 of m^1). Viewed in profile from the inner side (a' and b') cusps 4 and 5 will be seen to be not absolutely sharp-pointed, but already with the points slightly blunt.

The individual variation in the degree of wear at this stage is small. Figs. Ia and a' show the minimum, figs. Ib and b' the maximum among eleven individuals from the months of October and November.

Second stage (fig. II).—The worn edges of the commissures are in this stage twice to three times as broad as in stage I; the breadth (side to side) of the worn edge of cusp 5 is almost $1/2$, or in any case nearer $1/2$ than $1/3$ (in stage I roughly $1/4$) of the total length of commissure 2-5. The worn edge of cusp 6 begins now to assume in its central portion a pronounced subtriangular (irregularly triangular) shape, but is still sublinear in front of and

behind this central portion. Viewed in profile from the inner side (a' and b') cusps 4 and 5 are seen to be distinctly lower than in the first stage; the height of cusp 4 is now hardly equal to (in stage I rather more than) the distance between the tips of cusps 4 and 5; the height of cusp 5 is still equal to or a little more than (in stage I conspicuously more than) the same distance.

Twelve individuals in this stage have been examined. Figs. IIa, a' and IIb, b' represent the minimum and maximum of wear.

Third stage (fig. III).—The worn surfaces of the commissures are considerably increased in area; the breadth of cusp 5 is now between $1/2$ and $2/3$ of the total length of commissure 2-5. Equally, if not more, characteristic is the shape and enlargement of the worn surface of cusp 6; the "triangle" occupies now not merely the central portion of the ridge, but extends forward to the very base of cusp 4. Cusps 4 and 5 are worn considerably lower (IIIa' and IIIb'); the height of cusp 4 is much less than (about $1/2$ - $2/3$) the distance between the tips of cusp 4 and 5, the height of cusp 5 is somewhat less than the same distance.

There are seven individuals in this stage in the material from October and November. The minimum and maximum of wear are shown in fig. III a, a' and b, b'.

Fourth stage (fig. IV).—Easily distinguished from the third stage by the increased breadth of the worn surfaces of the commissures, the much enlarged triangular surface of cusp 6, and the considerably lower cusps 4 and 5. The breadth of the worn surface of the commissures at cusp 5 is now $3/4$, or more than $3/4$, of the total length of commissure 2-5. The triangular surface of cusp 6 tapered in stage III to a point at the foot of cusp 4, now it is quite broad in front, and the tooth worn quite thin at its antero-interior corner. Cusp 4 is now so low that it only rises a little above the worn surface of cusp 6, its height being about $1/3$ - $1/4$ the distance between the tips of cusps 4 and 5; cusp 5 is correspondingly lower its height about $1/2$, or less than $1/2$, of the same distance.

Six individuals show this stage. Fig. IV represents as usual the maximum and minimum of wear.

Fifth stage (fig. V).—The final stage, at least so far as my material goes; the molars are now worn down to the level of the gums. The characteristic features of this stage are these:—Cusp 4 has disappeared, having been worn completely down to the surface level; the worn surfaces of commissures 1-4 and 2-4 are therefore now perfectly confluent with the "triangle" representing the worn surface of cusp 6. Cusp 5, which from the very beginning is higher than cusp 4, has either nearly or quite disappeared. Although these differences in the degree of wear of cusp 5 are only individual (not indicative of different stages), as the word is here understood) it is important to note them, as they happen to give a

different aspect to the surface of the tooth. If cusp 5 has very nearly, but not quite, disappeared, the inner (median) margin of the confluent worn surfaces of commissures 2-5 and 3-5 closely approaches, but is not in contact with, the opposite margin of the worn surface of cusp 6 (fig. V a). Fig. V b represents an individual in which the two margins actually touch each other. Finally, Fig. V c, an individual in which these margins have disappeared, so that the worn surface of cusp 6 is confluent not only in front with commissures 1-4 and 2-4, but also posteriorly with commissures 2-5 and 3-5, and the deep pit, which in the less worn tooth separates cusp 4 from cusp 5, has been transformed into an island pit in the centre of the tooth. I have already alluded to the fact that these degrees of wear of cusp 5 are undoubtedly purely individual; the five October skulls representing this fifth stage of wear show perfect intergradations in this respect.

These are the stages of wear represented in a series of forty skulls of *Rhinolophus r. rouxi* from October and November (South Mysore and South Mahratha Country). Various reasons have led me to the conclusion that they are five consecutive stages, with one year between:—

First, the amount of wear leading from stage I. to II. is similar to that leading from II. to III, or from III. to IV, or from IV. to V, if we bear in mind the fact that the ratio of wear is gradually accelerated in proportion as the enamel coat is more and more completely worn away from the surface of the tooth. With this necessary qualification the stages are evidently equidistant so far as the amount of wear is concerned, and it appears reasonable to deduce that they are equidistant in point of time as well.

Second, I have submitted this conclusion to the test of all other available skulls of *Rh. r. rouxi* in so far as these are exactly dated. Apart from the forty October-November skulls, I have examined sixty-four from the months of January, February, April, and May, all from the same geographical district (N. Kanara, Savantwady, Konkan). Every one of these sixty-four skulls is easily referable to one or other of the five stages described above, allowing of course for the slight additional wear due to the more advanced season; the main point is, that there is no trace of the existence of any other "stage." Our series really seems to be complete, so far as it goes. It may be necessary to add these words, "so far as it goes," for it is just possible that a sixth stage occurs, one year beyond the fifth. I should hesitate to consider it probable, seeing that in the fifth stage the molars are practically reduced to the very level of the gums, but on the other hand it is not absolutely inconceivable that a sixth stage exists, though it would no doubt be rare.

Presuming, therefore, that our series is complete, we have of

course only to determine the age of the individuals of the first stage, which will give us at once the age of each of the subsequent stages. As to that question there is no uncertainty at all. The actual degree of wear in this first stage would be sufficient to tell us that the individuals can be only just adult, that is (supposing they were born in April or May) about six months old. This conclusion is further supported by the fact that in the case of five individuals in this stage I am able to say, on the strength of certain external characters, that they are "bats of the years."*

We are thus enabled to fix the ages of our October and November individuals as follows :—First stage, about 6 months; second, about 18 months; third, about $2\frac{1}{2}$ years; fourth, about $3\frac{1}{2}$ years; fifth, about $4\frac{1}{2}$ years. If to this we add a minimum of half a year and (supposing that a sixth stage does occur occasionally) a maximum of a year and a half, we arrive at five or six years as the extreme possible age of this bat. If one should have hazarded a simple guess at the probable age limit of a bat of this size, it would have been very much the same.

Strictly speaking, both the facts and the conclusions recorded above are, of course, only valid for *Rh. rouxi*, or more narrowly still for individuals of this species from South and Central India. I should think, however, that other bats of about the same size, with the same molar structure, and dependent on a similar diet, would not differ very much in this respect.

My object has been to determine the probable age of each individual in the series under consideration, and I have therefore confined myself to what was necessary for this purpose. To grasp the alterations taking place, from year to year, in a single tooth is really all that is needed, and by focussing the attention on one tooth, rather than describing in detail the alterations by wear in the whole tooth row, I hope I have made my paper not only much shorter, but clearer as well, and the facts more easy to remember. Still I ought perhaps in conclusion to add a few words about the other teeth.

The first upper molar is one of the teeth best suited for our present purpose; it is one of the most complicated in structure, and therefore shows most readily the effects of wear. The second molar differs in no very important point from the first, and might almost as well have been selected for description here; the surface wear affects it very nearly in the same way, and it reveals the age

* They are individuals who had just completed their first (autumn) moult, and the new coat of which was changing from the dark to the first (auburn) "phase". Their numbers are 1943 and 1947-1950, all from Seringapatam, South Mysore, 18th October 1911. (See the paper already referred to, on the colour phases of *Rh. rouxi*.)

of the individual almost as clearly as m^1 . The third (last) molar is somewhat degenerated, and both for this reason and owing to its position farthest back in the row the five stages of wear described above are not nearly so sharply separated from each other as in the case of m^1 and m^2 . The posterior premolar behaves somewhat differently from the molars; its sharply pointed cusp is the highest in the postcanine row, and its function is no doubt (so long as it retains this shape) chiefly to keep the food in position while it is acted upon by the molars; being not a "crusher" like the molar, but rather (together with the canine) a "fork," it is differently affected by the wear; in the earlier years of the individual it is more slowly worn than the molars, but a time comes (usually somewhere about the fourth stage) when the originally high cusp is worn low and at the same time all molars much flattened down, and it would seem that now the animal finds it advantageous to use it more as an additional crusher; from this period onwards it wears down much more quickly; as an indicator of age it is on the whole too capricious, too irregular in wear. The anterior premolar is a small rudiment; and the only remark it calls for in this connection is that, in spite of its minute size, it cannot be functionless; it is easy to see that it is acted upon by the high cusp of the posterior lower premolar, and it shows progressive stages of wear like all other teeth (with one exception pointed out below); even in extreme old age it is never absent. The upper canines are so simple, hook-like in shape, as to be of little value for our present investigation; the sharply pointed tip is, of course, worn blunt and the tooth gradually shortened, but it follows rather the rule of the posterior upper premolar, *i.e.*, the effect of the wear is slower in the earlier than in the later years, and the progress of the wear is somewhat irregular; in the majority of skulls in the second stage the tip of the canine is clearly slightly blunt, but there are other skulls in the same stage in which the canines would be hard to distinguish from those in the first stage. The minute upper incisors show very distinct signs of wear; they bite, not against the lower incisors (which close in far in front of the upper ones), but against the inner cingulum of the lower canines. The lower molars have a simple W-shape, *i.e.*, three cusps (1, 2, and 3) on the inner, two (4 and 5) on the outer side, cusp 6 and the heel (7) are absent; but in spite of the fact that they are considerably less complicated than the upper molars, I find that any of them might be used to measure the wear and age of the individual, though they are much more difficult guides than the first and second upper molars. The rudimentary middle lower premolar is usually squeezed out to the external side of the tooth row, though occasionally (in about 15 per cent. of the individuals) it is halfway or completely in row; it is sometimes external on one side of the jaw, more or less in row on the other; though even

smaller than the first upper premolar it is very rarely absent (in one skull only, among 134; this individual is not very old, little more than $2\frac{1}{2}$ years); it shows stages of wear, being acted upon, in certain positions of the jaw, probably by the tip of the upper canine. Of all teeth the lower incisors are the least affected by wear; I fail to see that they can possibly come into contact with any other teeth; even in the oldest individuals their edge very often, perhaps as a rule, remains trilobed.

In the unworn and little worn stages, the highest cusps in the upper molars are those in the middle row (4 and, even more, 5), in the lower molars the anterior outer cusp (4). The upper molars, therefore, slope from the middle outward, while the lower molars are highest at their outer side anteriorly. This is completely altered by the wear of the teeth. Owing to the fact that the lower tooth rows are much closer together than the upper, the lower molars act most vigorously on the middle and inner portions of the upper teeth, and the upper molars most strongly on the outer side of the lower teeth, with the result that in the final (fifth) stage of wear, when the molar surfaces are nearly or quite flat, the upper molar surfaces slope strongly and evenly from the outside inward, the lower molars from the inside outward.

Ages of 104 individuals of Rhinolophus rouxi.

Subjoined are the details of all the dated specimens examined. All except seven were collected by Mr. Shortridge for the Mammal Survey of India.

1. *October and November individuals.*

28 specimens (all adult females), Seringapatam, S. Mysore, 18th and 19th October, 1912. 12 specimens (4 ♂ ad., 8 ♀ ad.), Devikop, 26 miles south of Dharwar, S. Mahratha Country, 21st and 25th November, 1911. The November specimens are marked with an asterisk. Total number, 40.

Stage I (about 6 months old).—10 individuals. G.C.S. 1943, 1947, 1948, 1949, 1950, *137, *139, *141, *174, *177.

Stage II (about 18 months old).—12 individuals. G.C.S. 1936, 1939, 1954, 1955, 1957, 1958, 1959, 1960, 1962, *134, *138, *178.

Stage III (about $2\frac{1}{2}$ years old).—7 individuals. G.C.S. 1934, 1937, 1946, 1956, 1963, *179, *181.

Stage IV (about 8½ years old).—7 individuals. G.C.S. 1935, 1938, 1944, 1961, *140, *180.

Stage V (about 4½ years old).—5 individuals. G.C.S. 1940, 1941, 1945, 1951, 1964.

2. *January and February individuals.*

2 specimens (σ ad.), Sirsi, N. Kanara, 11th January, 1900. 19 specimens (4 σ ad., 15 φ ad.), Potoli, south-east of Supa, N. Kanara, 18th and 19th January, 1912. 3 specimens (1 σ ad., 2 φ ad.), Dandeli, 15 miles east of Supa, N. Kanara, 21st January, 1912. 2 specimens (σ ad.), Barchi, 10 miles east of Supa, N. Kanara, 28th January, 1912. 1 specimen (σ ad.), Yellapur, N. Kanara, 20th February, 1900. The single February specimen is marked with an asterisk. Total number, 27.

Stage I + (about 9 months old).—11 individuals. B.M. 0.4.1.6 G.C.S. 519, 520, 522, 529, 541, 546, 547, 556, 557, 564.

Stage II + (about $1\frac{3}{4}$ years old).—12 individuals. B.M. 0.4.1.7 and *0.4.1.8. G.C.S. 523, 524, 525, 526, 528, 540, 542, 544, 548, 563.

Stage III + (about $2\frac{3}{4}$ years old).—3 individuals. G.C.S. 527, 543, 545.

Stage IV + (about $3\frac{3}{4}$ years old).—1 individual. G.C.S. 558.

Stage V + (about $4\frac{3}{4}$ years old).—None.

April and May individuals.

10 specimens (all adult males), Sirsi, N. Kanara, 8th to 12th April, 1912. 3 specimens (1 σ ad., 2 φ ad.), Nerur, Savantvadi, 17th April, 1911. 21 specimens (15 σ ad., 6 φ ad.). Hulekal, near Sirsi, N. Kanara, 18th to 26th April, 1912. 1 specimen (sex uncertain), Asgani, Konkan, 3rd May, 1911. 2 specimens (σ ad.), Gersappa, N. Kanara, 19th and 23rd May, 1912. The May specimens are marked with an asterisk. Total number 37.

Stage 1 + (about 1 year old).—21 individuals. B.M. 11.7.18.3 and 4. G.C.S. 853, 898, 956, 957, 958, 959, 960, 962, 964, 965, 966, 967, 987, 988, 989, 1009, 1012, *1158. B.M. *11.7.18.1.

Stage II + (about 2 years old).—12 individuals. G.C.S. 847, 895, 896, 897, 899, 900, 910, 990, 994, 996, 1011, *1120.

Stage III + (about 3 years old).—4 individuals, B.M. 11.7.18.2. G.C.S. 889, 961, 1010.

Stage IV + and V + (4 and 5 years old). None.

The total number of individuals in stage I or between I and II is, therefore, 42 (40.4 per cent.); in stage II or between II and III, 36 (34.6 per cent.); in stage III or between III and IV, 14 (13.5 per cent.); in stage IV, or between IV and V, 7 (6.7 per cent.); in stage V, 5 (4.8 per cent.). If this series taken as a whole, gives anything like the normal proportion of individuals found in nature at the different stages of age, it will be seen that individuals up to

two years old ($\frac{1}{3}$ of the extreme possible age) form 75 per cent. of the total "population"; individuals up to the three years limit (half the extreme span of life) no less than 88.5 per cent. But 104 is, of course, far too perilously small a number to serve as a basis for an age census, and I do not attach too much importance to the percentages here arrived at, though it is a fact that they agree very well indeed with my experience as to the great abundance of individuals with little or moderately worn teeth and the relative scarcity of aged and senile individuals in any series of bats, of any species. Twelve different localities are represented in this series of 104 specimens, but only in one single place was the oldest stage (V) secured.

Explanation of plate.

All figures are of the subspecies *Rhinolophus rouxi rouxi*, and all individuals are from October or November. Figures I—V represent the anterior upper molar (m') of the left side, viewed from the surface and from the inner side, and in about 10 times natural size. Those marked I are in the "first" stage of wear as defined in this paper, those marked II in the second, and so on. In all figures, a and b (and c , if present) are surface views, a' and b' (and c') inner and somewhat oblique side views. Figures A and B (top of plate) are given for the information of those who are not familiar with the dentition and molar structure of this bat.

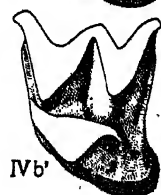
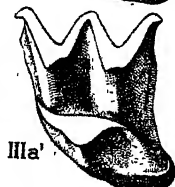
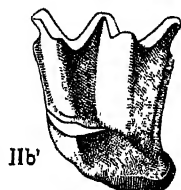
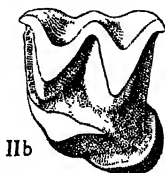
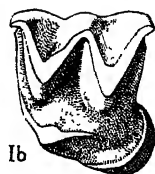
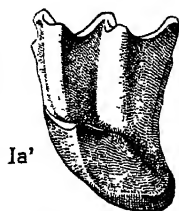
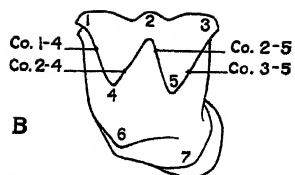
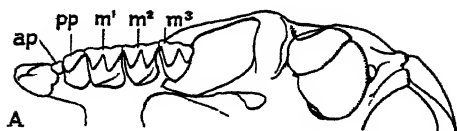
Fig. A.—Palate view of left half of skull, to show dentition. ap , anterior premolar; pp , posterior premolar; m^1 , first, m^2 , second, m^3 , third molar. About 2.8 times natural size. (\varnothing ad., Seringapatam, S. Mysore, 18th October, 1912, G.C.S. 1943).

Fig. B.—Anterior upper molar, left side, enlarged, to explain structure. 1, 2, and 3, the three cusps of the outer row; 4 and 5, the two cusps in the middle row; 6, inner cusp; 7, heel. The commissures are marked co ; $co. 1-4$ is the commissure between cusps 1 and 4; $co. 2-4$, the commissure between cusps 2 and 4; and so on. (Same specimen as fig. A.)

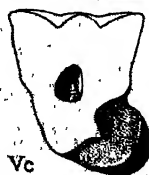
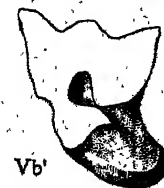
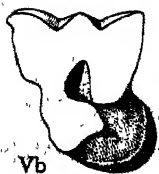
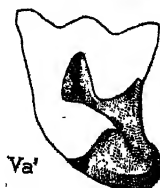
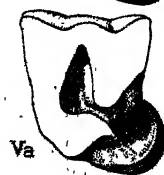
Fig. I.—First stage of wear (individuals about 6 months old). a (surface view) and a' (inner side view) represent the minimum of wear found in this stage (\varnothing ad.; Seringapatam, S. Mysore, 18th October, 1912, G.C.S. 1943). b and b' , maximum of wear in this stage (σ ad. same place and date, G.C.S. 1949).

Fig. II.—Second stage (about 18 months old). a and a' , minimum of wear (\varnothing , Seringapatam, S. Mysore, 19th October, 1912, G.C.S. 1957). b and b' , maximum of wear (\varnothing , same place, 18th October 1912, G.C.S. 1939).

Fig. III.—Third stage (about 2½ years). a and a' , minimum of wear (\varnothing , Seringapatam, 18th October, 1912, G.C.S. 1937). b and b' , maximum (\varnothing , same place and date, G.C.S. 1934).



TERZI



- Fig. IV.—Fourth stage (about $3\frac{1}{2}$ years). *a* and *a'*, minimum of wear (♀, Seringapatam, 18th October, 1912, G.C.S. 1938). *b* and *b'*, maximum (♀, same place and date, G.C.S. 1944).
- Fig. V.—Fifth stage (about $4\frac{1}{2}$ years). *a* and *a'*, minimum of wear (♀, Seringapatam, 18th October 1912, G.C.S. 1940). *b* and *b'*, medium degree of wear (♀, same place, 19th October, 1912, G.C.S. 1951), *c* and *c'*, maximum (♀, same place, 18th October, 1912, G.C. S. 1945).
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ON THE SO-CALLED COLOUR PHASES OF THE RUFOUS
HORSESHOE-BAT OF INDIA (*RHINOLOPHUS*
ROUXI, TEMM.).

BY

KNUD ANDERSEN, F.Z.S.

(With Plates I and II.)

It has long been known to Mammalogists that certain species of *Rhinolophus*, Oriental as well as Ethiopian, show an extraordinary variability in the colour of the fur. The extremes of these colour types, or "phases" as they have been called, are often so strikingly different, the one being dull mouse-brown, the other brilliantly orange-chrome without a trace of brown anywhere in the pelage, that one can hardly be surprised that they have in some cases been described as different species.* Such extremes are often represented among specimens from the same locality, and if the series obtained is large enough it will often show several intermediate "phases." No wonder that as soon as it was realized that all this was merely "individual variation," some authors refused altogether to consider the colour of the fur a character of taxonomic value in bats.

Rhinolophus is by no means the only genus showing colour varieties of this kind. More or less similar phases occur in many species of the allied genus *Hipposideros* (e.g. in the *commersoni*, *bicolor*, *speoris*, *galeritus* and *caffer* groups); further in *Asellia*, *Tricenops* and *Rhinonycteris*, all of which are closely allied to *Hipposideros*; again in *Nycteris*, and in some *Phyllostomatidae*, *Emballonuridae*, *Molossidae*, and *Vespertilionidae*. They may be found to exist also in other families of Chiroptera,—in any case it is evident that their occurrence is a rather common phenomenon in bats.

Hitherto nothing has been known of these phases beyond the mere fact of their existence. Whether they are seasonal, or whether the individual moults "true" to its phase during the whole of its lifetime, are questions which, so far as I am aware, nobody has attempted to answer. The scarcity of large, carefully dated and sexed series of skins sufficiently explains why nobody has felt tempted to attack the problem.

Owing to the fine work recently done by the collectors for the Bombay Natural History Society's Mammal Survey of India this scarcity of material no longer exists so far as certain Indian species of *Rhinolophus* and *Hipposideros* are concerned. And it happens

* The Rufous Horseshoe-bat of India is a case in point. Kelaart's *Rhinolophus cinerascens* (Prodromus Faune Zeylanicae, 1852) is the dark, his *Rh. rammanika* an intermediate, and his *Rh. rubidus* the orange "phase" of *Rh. rouxi* (see P. Z. S. 1905, ii, p. 99).

that one of the Horseshoe-Bats most richly represented in the Survey collections, *viz.*, *Rh. rouxi*, is a species which exhibits the colour extremes in their strongest contrasts, and at the same time presents the widest range of intermediate phases. The number of skins of this bat thus far brought together during the progress of the Survey amounts to 98; in addition there are 18 specimens preserved in alcohol, and I have had six dated skins from other sources, giving a total of 122 specimens. All specimens are adult, representing every degree of wear of the teeth, from the practically unworn condition ("stage I," *i.e.*, individuals about six months old*) to the stage in which the crowns are worn down to the gums ("stage V," four and a half year old individuals). 46 are males, 76 females. They were obtained in South Mysore (Seringsapatam, 34); South Mahratha Country (Devikop, 12); various places in North Kanara (Gersoppa, Hulekal, Sirsi, Barchi, Dandeli, Potoli, Yellapur, 72); Savantvadi (Nerur, 3), and Konkan, (Asgani, 1),—places sufficiently close together to be regarded, even in the narrowest sense of the term, as one geographical district. They all belong to one subspecies, *Rh. rouxi rouxi*†, and all the Survey specimens (116) were collected by Mr. Guy C. Shortridge. It is one of the finest series of specimens of any form of *Rhinolophus* that has ever passed through my hands.

Although certainly large and varied enough to illustrate the remarkable variability of colour shown by *Rh. rouxi*, this series is on the other hand not complete enough to allow one to follow the changes in the fur through every month of the year. It was not, it should be remembered, collected for this special purpose, but simply as part of the general Mammal Survey of this portion of India. Only six months are represented in the series, *viz.*, October, November, January, February, April and May, that is, the cold season (about October to January and February) and the hot and dry season (February to May) are represented, whereas there is

* See my paper. "On the determination of age in Bats," this Journal, *antea*.

† The distribution of *Rh. rouxi*, so far as it is as yet traceable, is as follows:—It is known from many places in Ceylon; in the Peninsula from the Nilgiri Hills in the south, through South Mysore, South Mahratha Country, North Kanara, Savantvadi, and Konkan, as far north as Bombay. Ceylon specimens are apparently indistinguishable from those from India proper, and I refer them all to the subspecies *Rh. r. rouxi* (with the necessary reservation that I have not yet had an opportunity of examining Temminck's types in the Leyden Museum). North of Bombay there is a big gap in the known distribution of the species, though whether it is a real breach in the area inhabited by this bat, or merely a gap in our material, it is impossible to say. Passing north from Bombay we meet the species again in Masuri (Dehra Dun), Kumaon, Nepal, Darjiling and Bengal; and further east it turns up again in South China (Anhwei, Lower Yangtse). Specimens from all these places (Masuri to Anhwei) are distinguishable as a subspecies (*Rh. r. sinicus*). It is possible, though by no means certain, that the two subspecies are connected with each other along the east coast of India, which has not yet been worked by the Survey.

not a single specimen from the whole of the rainy season (June to September). As it is, however, the series is sufficiently complete to solve the principal problem, namely, what do these colour "phases," this unparalleled variability in colour mean?

The first question we have to settle, before trying to unravel the mystery of the colour phases, are naturally these :—When does this bat change its coat? Does it moult once or (as usual among Mammals) twice a year? And what is the new coat like? Does it show the same "individual variation" in colour as exhibited when glancing down the whole series of specimens before us?

Fortunately the material gives clear answers to these preliminary questions. *Rh. rouxi* moults twice a year, in this part of India in October and again in May, and in both cases the new fur is dark brown above, grey on the underside of the body,—the ordinary bat colour, or very much like the colour of a House Mouse.

Where then do the brilliantly orange and the intermediate phases come in? To give the facts at once, before entering into details, *these phases are due to a gradual*, and on the whole evidently rather rapid, *change of the colour of the full grown hair*.

In order to follow the changes of the coat and colours in detail we must now examine the appearance of the specimens month by month, so far as the material allows.

There are twenty-eight skins dated October (1912), all from one locality (Seringapatam, S. Mysore), and very nearly of the same date (18th and 19th); all are females and all fully adult* (epiphyses of metacarpals ossified); the actual ages of the individuals are as follows :—Five are about six months old, nine about eighteen months, five two and a half years, four three and a half years, and five four and a half years. For reasons explained below we must put the youngest generation ("bats of the year," six months old) on one side; they require special description. The remaining twenty-three specimens may conveniently be divided into two groups, those in the process of moulting (fifteen), and those which have just completed, or practically completed, their autumn change of coat (eight).

(1) Fifteen October individuals, aged from one and a half to four and a half years, showing various stages of moult from the old orange to the new dark brown coat.†—Three specimens (1935, 1936, 1940) exhibit the initial stages of the change of fur. They are nearly orange-rufous (II, 11, h to j ‡) above, approximately mars-

* That is, full grown; which does not necessarily imply that they are all sexually mature; this is certainly not the case with the youngest class of individuals (those only six months old).

† Collector's numbers: G.O.S. 1934, 1941, 1944—1946, 1951, 1959, 1961, 1964.

‡ All colours are determined from Ridgway's "Color standards and Color Nomenclature," Washington, 1912, and the references between parentheses are to the plates of that book.

yellow (III, 15, i) or ochraceous-orange (XV, 15') beneath. The new dark hairs appear on the back of the neck and anterior dorsum; on parting the fur of these regions of the upper side it looks, on a hurried inspection, as if the coat had dark bases to the hairs; the dark "bases" are in reality the new short dark-coloured crop of hair. On the underside the new grey coat appears on the throat, chest, anterior portion of flanks, and anal region, leaving the breast, belly, and posterior flanks mars-yellow or ochraceous-orange. One of these specimens (1935) is figured on pl. I, fig. 1. The twelve other October specimens of this group illustrate the gradual progress of the moult. The new dark brown (mouse-coloured) fur spreads on the upperside from the back of the neck forward, over the head, and backward, over the middle of the dorsum, so that the last remnant of the old orange coat is, as a rule, an orange stripe along each side of the rump, next to the membranes (as in specimen 1944, figured on pl. I, fig. 3); at the same time the new grey hair of the underside spreads from the throat outward to the sides of the neck, and from the flanks and anal region mediad and forward over the belly, so that the last portion of the old mars-yellow coat to disappear is, in most individuals, a transverse stripe or crescent across the thorax (same specimen, pl. I, fig. 3).

(2) Eight October specimens (same ages as above) showing the completed moult.*—These are in new coat without trace or with only very slight traces of the old. The pelage of the upperside is roughly dark brown (approaching clove-brown, XL, 17''', m), but faintly powdered with greyish, owing to the extreme tips of the hairs being of this colour, and the base of the fur is again paler; the underparts are nearly uniform mouse-grey (LI, 15'''). One (1958) is figured on pl. I, fig. 4.

Let us pause for a moment to consider what these two groups of October specimens have taught us. In the first place, we have seen that this bat has an autumn moult †, which, at least in this part of India, takes place in October; we must, of course, even within the same province, allow for some variation of the exact date; some individuals may begin moulting already late in September, others perhaps as late as early in November, though of this there is no direct evidence in our material. Secondly, the old orange fur is replaced not by a new orange coat, but by a coat of dark brown and grey (mouse-coloured) hair. What happens to this new very plain-coloured coat we shall see in a moment, but first we must examine the bats of the year.

* Collector's Numbers, G.C.S. 1954-1958, 1960, 1962-1963.

† It seems to me unnecessary to change these terms, "spring moult" and "autumn moult," "summer coat", and "winter coat" when dealing with a tropical Indian mammal. The moults (in this bat) in fact take place very nearly at the same time of the year as in temperate climates, and the terms can hardly cause any confusion.

(3) Five October specimens, aged about six months.*—One of these individuals (No. 1949) is perhaps the most interesting in the whole Survey series of this species. It is a bat of the year which (1) has already completed its first autumn moult, and (2) happens to have been killed while it was changing the colour of this new coat from dark brown into auburn above, and from mouse-grey into ochraceous-tawny beneath. That this individual is in its first adult coat, not in the coat of the immature, is evident for two reasons:—The coat is new and fresh, not old and worn, as it would obviously be, if it were the baby coat; and anybody familiar with the peculiar dull testaceous tinge of the coat of the immature *Rh. rouxi* will see at a glance (although the colour is already, even where it is darkest, somewhat affected by the change into a brighter "phase") that it is not the tinge of the immature pelage. But the second statement, *viz.*, that the hair, in the moment the bat was killed, was changing colour undoubtedly needs strong evidence to be accepted. Some reader looking at the figure of this individual on pl. II (fig. 5) might say:—"What I see is a specimen which (speaking of its upperside only) is roughly half auburn and half brown; why then is this not an individual like those of group one above, that is, an individual in moult?" There are at least three reasons why this is not so; each of them would be sufficient in itself, and the combination of them therefore certainly places the matter beyond reasonable dispute. Firstly, if it were moulting it must either be moulting from the auburn into the brown phase (like the older October individuals, under group one, above, though those individuals were, of course, not auburn but orange), or *vice versa*; there are no other alternatives. If it were moulting from an auburn to a brown coat, it would follow that the auburn coat was the old one, *i.e.* (remembering it is a bat in its first autumn) the baby coat; but in all my work with Horseshoe-Bats (now extending over a series of years during which I have handled thousands of specimens belonging very nearly to every form known) I have never yet come across a single immature specimen in bright (auburn or orange) coat; whenever an auburn or orange specimen turned up, it was always adult; at least so far as *Rhinolophus* and *Hipposideros* are concerned, the bright phase may safely be said to occur only in the adult. Turning then to the other alternative, that this individual might have been moulting from a brown to an auburn coat, we find it negatived by the facts already pointed out above, that the brown hairs are not old and worn, but (even though examined under a dermatoscope) as new and ungraded as are the auburn, and that the brown tinge of these hairs is certainly not that of the coat of the immature. Secondly, if this bat were moulting, it must, judging

* Collector's Numbers, G.O.S. 1943, 1947-1950.

from the fact that the auburn and brown areas are about equal in extent, be only about half-way through the moult, and in that case we should find somewhere in the fur evidence of new hair coming up, shorter than the rest; but there is no evidence whatever of this kind, all the hairs are full grown, all of their proper length, there is on the whole surface of the animal not a single spot showing a new crop of hair. Thirdly, the moult, as we have already seen (October specimens, group one, above), proceeds along definite lines, the new fur of the upperside first appearing on the back of the neck, spreading outward to the sides of the neck and backward along the median line of the dorsum, so that the last portion of the old fur to disappear is an orange stripe on each of the back and rump along the lateral membrane (see figs. 1, 2, and 3). A glance at fig. 4 will show how entirely differently our specimen behaves, both above and beneath. For these reasons there can be no doubt that our specimen was killed while changing the colour of its new full grown coat. This result is further supported by an examination of the four other individuals of this group, all of which are of the same age. The change of colour is in all four carried a good deal further than in No. 1949, is in fact *nearly* completed. The upperside is approximately auburn (II, 11, m) above, this colour gradually lightening to cinnamon (XXIX, 15'') toward the base of the hair, while the underside is ochraceous-tawny (XV, 15', i). But the change is only "nearly" completed; there is still, in all four examples, a conspicuous amount of greyish colour on the throat (this disappears, as we shall see, in the following month), and in one specimen (1948) there is a small patch of grey left on the belly.

To the conclusions derived from groups one and two of the October individuals (see above) we can now add those obtained by our examination of group three, *viz.*, (1) Bats of the year undergo an autumn moult, like the older individuals; (2) this new coat is quite similar to the new coat of older individuals, dark brown above, mouse-grey beneath; (3) but this new coat (at least in the individuals we have seen thus far) when fully developed changes its colour into auburn above, ochraceous-tawny beneath; (4) this colour change probably takes place comparatively rapidly.

Even if we had never seen the five October specimens of "group three" we should have been forced to the conclusion that shortly after the autumn moult the colour of the new coat *must* change. We have seen that when orange specimens moult in October they put on a mouse-coloured coat. But we shall find that already in November (and then throughout the "winter") plenty of auburn and orange specimens occur. How could this fact be explained, otherwise than by a change of colour of the fullgrown hair?

We are now evidently well on the way to a better understanding of the colour phases in this bat, and can proceed to examine more

closely the specimens from the next following months, as far as our material goes.

The November series (twelve skins*) shows some further brightening of the colours. The darkest individuals (♀ ad., No. 138, age, about a year and a half, figured on pl. II, fig. 6; ♂ ad., No. 139, about six or seven months) are very similar to the auburn October specimens just described, except in so far as the last traces of grey on the throat and belly have now disappeared, having been changed into ochraceous-tawny. In the most advanced November individual (♂ ad., No. 174, six to seven months old) the colour of the whole of the upperside has brightened into light Sanford's brown (II, 11, j) or hazel cinnamon-rufous (XIV, 11', j) toward the base of the fur; that of the underside into a tinge approaching ochraceous-orange (XV, 15', h). Better than by any description the difference between these two November extremes will be appreciated by comparing the patterns "auburn" with "Sanford's brown" and "hazel" on plates II and XIV of Ridgway's "Color Standards," and "ochraceous-tawny" with "ochraceous-orange" on plate XV. The nine other November skins fit in between these extremes.

I have seen no specimens from December, but twenty-four skins in the Survey collection show the appearance of the fur in the month of January.† One individual (♂ ad., Dandeli, No. 556, probably about nine months old) has remained very nearly in the auburn phase (see October and November, above), the only tangible difference being that the "auburn" of the upperside is perhaps a tone paler (more approaching to argus-brown, III, 13, m), and the ochraceous-tawny of the underparts a faint shade lighter. Several skins are similar to the brightest November individual described above. But the majority exhibit more advanced stages of colour modifications (see pl. II, fig. 7). The head and upperside are orange-rufous or a shade paler still (II, 11, i and h), brightening to orange-chrome (II, 11) at the base of the hairs; the underparts between ochraceous-orange and yellow-ochre (XV, 16'). The palest individual of all (♀ ad., Potoli, No. 522, about nine months old, figured on pl. II, fig. 8) has the upperside nearly xanthine-orange (III, 13, i or h), the underparts pale yellow-ochre (XV, 17', a). It is closely approached by some other specimens from January, and practically exactly matched by the single skin from February

* Four adult males, eight adult females; Devikop, S. Mahratha Country; November 21st and 25th; ages, from about seven months to three and a half years; Collector's Numbers, G. O. S. 184, 187-141, 174, 177-181.

† Seven adult males, seventeen adult females; Barochi, Dandeli, and Potoli, three places situated quite close to Supa, North Kanara; Jan. 18th, 19th, 21st and 28th, ages, from about nine months to about two years and nine months; Collector's Numbers, G. O. S. 512, 520, 523-529, 540-545, 550-558, 563, 564.

(♂ ad. Yellapur, N. Kanara, 20th February, B. M. O. 4. 1. 8, about one year and nine months old) and by several from April.

Individuals which have passed into this brilliantly orange colour phase no doubt remain there till the "spring" moult. As stated above, the only February skin I have seen is in this phase; from March no skins are available; but I have before me a long series from April, a considerable number of which are as bright-coloured as the brightest January specimens. It is probable, however, that shortly before the next moult sets in (May) the colours lose a little of their gloss and brightness. I have unfortunately no "spring" specimens moulting from the orange into the dark mouse-coloured phase, but October specimens changing from orange to dark pelage exhibit this slightly duller appearance of the old orange coat.

Such are the colour changes from October to April-May in individuals which run through all phases. But a very important fact I now have to call attention to. Although the individuals which pass through the whole scale of colour changes are decidedly in the majority in my dated material (the whole of which, it should be remembered, is from the region of the Peninsula between S. Mysore and the Konkan), a certain, and by no means small, percentage of specimens stop short at an intermediate phase (never, throughout the half-yearly period here under consideration, passing beyond that stage), while others can even hardly be said to pass into any bright phase at all, the coat being subject only to a rather ordinary fading of its colours. I will deal with these two categories of specimens separately:—

First, individuals remaining at an "intermediate" colour phase.—The first phase into which the freshly moulted (mouse-brown and mouse-grey) October coat passes is (as we have seen above) the auburn phase. We found already in October some individuals which were either on the point of changing the colour of the coat into auburn or had practically completed this change, and I took this as evidence that this colour change must take place rapidly; further, we found the fully developed auburn phase in the November series. But, as mentioned above, there is in the Survey series from January, that is, at a time when most individuals have passed into a bright orange phase, one individual (a nine months old male, No. 556) which has remained in the auburn stage; and there is in the British Museum collection another skin from January (♂ ad., Sirsi, North Kanara, Jan. 11, 1900, No. O.4.1.6, about nine months old) in exactly the same phase. Even much later in the season the auburn phase is met with. The April series numbers thirty-four, and of these four are auburn, while a few others are only a little more advanced. There

is no doubt, therefore, that some individuals remain in the auburn stage throughout the whole season.

Secondly, individuals which hardly assume any bright phase at all.—In the British Museum is a skin from January (♂ ad., Sirsi, North Kanara, Jan. 11, 1900, No. O. 4.1.7, about one year and nine months old) which has not even entered the auburn stage. And in the large April series there are nine of which the same may be said*. If these ten skins are placed along with the freshly moulted, "mouse-coloured" October individuals, it is easy to see that the colour has certainly altered to some extent. The upper-side has in six specimens turned from the original rather dull mouse-brown (finely powdered with greyish) into a warmer brown tone, somewhat approaching to sepia and bister, and the originally greyish bases of the hairs have acquired a slight ecru tinge; further, the under parts are no longer mouse-grey, but rather drab-grey (XLVI). In the four remaining specimens the brown of the back is distinctly "diluted" or "washed" with a pale yellowish tinge, but not sufficiently so to alter the general brown total impression of the colour; and the tinge of the under-parts is a decidedly warmer drab (not quite as bright as "avel-laneous", XL). None of these could truly be described as belonging to the first, auburn phase, while on the other hand the colour is decidedly altered slightly in the direction of that phase.

That some specimens retain this colour right up to the spring moult is proved by two of the three May specimens before me. These two are the only individuals showing the spring moult. One is roughly bister, the other of a warmer brown above, but not auburn. The new fur is exactly like the fresh October fur in colour.

Not a single specimen is available from the whole period June-September. But that the "summer" coat passes through a series of colour phases similar to those described for the "winter" coat, is hardly open to doubt, if we remember the fact that the October material contains numerous individuals moulting from the orange phase into the dull mouse-brown.

One very curious fact remains to be mentioned. It is not only the fur that changes its colour, *even the claws, those of the feet as well as that of the pollex, partake in these changes.* The details are as follows:—

In all the specimens moulting from the orange to the mouse-brown phase (October) the claws are of the usual transparent horn-

* The April material (34 skins, 31 of which belong to the Indian Survey collection) therefore shows the following colour stages:—9 brown (ages, one to three years), 8 auburn or a little beyond (one to three years), 17 orange (one to three years).

colour, without a trace of any other tinge. In the next colour stage of the fur, the auburn phase, the claws are either unchanged, or they begin to show a distinct deep reddening at the tips. In this phase we often find one or two claws of a foot unaltered in colour, while the others begin to change into deep blood-red. As a rule the claws of the feet are affected a little earlier than that of the pollex. Finally, in the orange phase of the fur, we find invariably the claws red. The colour always starts at the tips of the claws, spreading backward, though it is comparatively seldom that it reaches right to the exposed bases of the claws. The tinge is a beautiful blood colour, totally different from the original colour of the claws; it looks as if the claws had been dipped in blood, sometimes the tips only, often for half their length or more. It will be noticed that the colour changes of the claws progress *pari passu* with those of the fur:—never any red in the claws in the non-orange phases, but the more brilliant the orange of the fur, the more extensive the red colour of the claws. The red colour is not superficial, but goes right through the horny substance.

The colour changes in the full grown hair described above are perhaps without true parallels in the whole class of Mammalia, outside the order of Chiroptera. There are, of course, numerous instances of even very remarkable fading of colours. One of the cases which no doubt would most readily occur to the minds of British Mammalogists is the very striking and somewhat rapid change of colour in the tail of the British Squirrel*. But I fail to see any real parallel in that case. What happens in the Squirrel's tail is a fading from seal-brown through gradually paler tinges of brown to pale buff or nearly white; in other words, a gradual dilution, and finally complete or almost complete disappearance, of *all* pigment in the hairs of the tail. In *Rh. rouxi* (and probably in other bats with similar phases) the pigment does not disappear, but (as we shall see in a moment) it gradually, though rapidly, changes from one colour into a totally different one. There may be (in fact, I believe there are) better parallels among birds. Every ornithologist will know of scores of cases of alleged colour change (without moult) in full-grown feathers, but I am not aware of any case in which the *whole* of the plumage of a bird (like the whole of the pelage of *Rh. rouxi* and many other bats) is affected by the change.

Together with my friend Mr. Martin C. Hinton (who is engaged in investigations of the hair structure of certain Rodents), I have examined the hair of *Rh. rouxi* microscopically. The pigment

* Oldfield Thomas. The seasonal changes in the Common Squirrel; *The Zoologist*, November 1896, pp. 401-407.

consists of minute granules arranged in longitudinal rows so as to produce a striated appearance of the hair (magnification, 710 diameters). In the newly moulted, mouse-coloured fur (dorsal region, specimen No. 1955) the colour of the pigment is some tinge of olive; in the bright phase (dorsal region, specimen No. 520) *this colour of the pigment has changed to orange*. How this change is effected is, of course, a question for the bio-chemist, but it appears probable that it is due to oxidation. If this is so, one may perhaps hazard the hypothesis that in individuals which show no colour change of this kind, or which stop short at an intermediate (auburn) phase, the oxidizing element may either be entirely absent or wholly or partly counteracted by some other factors.

Summary.

(1) The coat of the young *Rhinolophus* (any species) is darker (duller, more matt) than that of the adult. I have seen very few immature individuals of *Rh. rouxi*, but those examined are of this dark and dull tinge. An immature individual in the bright (auburn, orange) phase I have never seen in any species of *Rhinolophus* or *Hipposideros*; it is improbable that the coat of the immature ever shows such colour.

(2) *Rh. rouxi* moults twice a year. In South Mysore and North Kanara the "spring" moult takes place in May, the "autumn" moult in October. Whether there is any considerable variation in the time (month) of the two annual changes of coat, either among individuals inhabiting the same geographical area, or between individuals from widely separated areas of India, are questions not answered by my material. The autumn moult is certainly complete (i.e., affects the whole of the pelage). The same is probably the case with the spring moult, but the material available is very small (two examples only).

(3) The fresh fur, both in spring and autumn, is mouse-brown above, mouse-grey beneath.

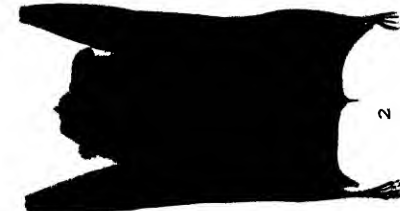
(4) In a large number of individuals this colour of the new, full grown coat changes (probably rather rapidly) into much brighter tinges, the upperside through auburn and Sanford's brown to orange-rufous or even xanthine-orange, the underparts through ochraceous-tawny to ochraceous-orange or even yellow ochre. This explains the enormous "individual variation" in colour in this species (as it is no doubt explains similar or corresponding colour variations in other bats). In autumn the colour change takes place immediately after the moult, in October and November; the exact time when it occurs in the spring coat is not shown by my material but it will probably be found to be in May and June. Every hair of the coat, and the whole of every hair, from tip to base, is affected by the colour change.



BOMBAY NAT. HIST. SOC. MAMMAL SURVEY.
18 Dec 52
Rhinolophus roulei
Sebangaphilus s. s. s. s.
ALT. 2350 ft. COLL. G. C. SHYKTEKID.



H & B 64
TL 27
Hr (SU) 11
Ear 20



BOMBAY NAT. HIST. SOC. MAMMAL SURVEY.
18 Dec 52
Rhinolophus roulei
Sebangaphilus s. s. s. s.
ALT. 2350 ft. COLL. G. C. SHYKTEKID.



H & B 62
TL 26
Hr (SU) 12
Ear 19



BOMBAY NAT. HIST. SOC. MAMMAL SURVEY.
18. 11. 52
Rhinolophus roulei
Sebangaphilus s. s. s. s.
ALT. 2350 ft. COLL. G. C. SHYKTEKID.



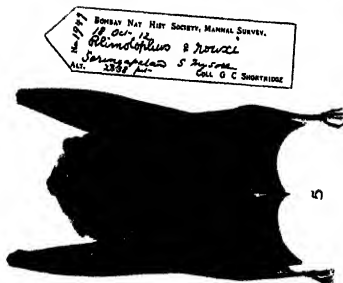
H & B 64
TL 29
Hr (SU) 12
Ear 19.5



BOMBAY NAT. HIST. SOC. MAMMAL SURVEY.
19 Dec 52
Rhinolophus roulei
Sebangaphilus s. s. s. s.
ALT. 2350 ft. COLL. G. C. SHYKTEKID.



H & B -
TL -
Hr (SU)
Ear -



BOMBAY NAT. HIST. SOCIETY. MAMMAL SURVEY.
18 Dec. 12
Rhinolophus roulei
ALT. 2500 ft. from *Point* Col. G. C. SHOOTING



On H.B. 62
TL 26
HI (SU) 12
Ear 20
Skull



BOMBAY NAT. HIST. SOCIETY. MAMMAL SURVEY.
18 Dec. 12
Rhinolophus roulei
ALT. 2500 ft. from *Point* Col. G. C. SHOOTING



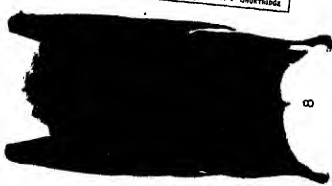
On H.B. 65
TL 27
HI (SU) 11
Ear 20
Skull



BOMBAY NAT. HIST. SOCIETY. MAMMAL SURVEY.
18 Dec. 12
Rhinolophus roulei
ALT. 2500 ft. from *Point* Col. G. C. SHOOTING



On H.B. 61
TL 26
HI (SU) 11
Ear 20
Skull



BOMBAY NAT. HIST. SOCIETY. MAMMAL SURVEY.
18 Dec. 12
Rhinolophus roulei
ALT. 2500 ft. from *Point* Col. G. C. SHOOTING



On H.B. 58
TL 26
HI (SU) 11
Ear 19
Skull

Colour changes in RHINOLOPHUS ROUXI.

MEMPHIS PRESS WATFORD.

(5) Not all individuals pass through the whole scale of colour changes. A not inconsiderable number would seem to remain in the auburn stage; such individuals have been obtained not only in October and November (when we should naturally expect them), but also in January and April, together with specimens showing the extreme of the orange phase. Others show an even more limited "colour plasticity," the colour of the upperside changing only into sepia or bister, with or without a distinct yellowish "wash," the underparts into drab-grey. Such individuals are represented in the material from January, April, and May (moulting).

(6) The claws (feet and pollex) change colour together with the fur turning from transparent horn brown to deep blood red. The degree of colour change of the claws seems to be directly proportional to the degree of colour change of the fur; *i.e.*, the dark brown phase shows no colour change in the claws, this begins only with the auburn stage, and reaches its maximum (both in the intensity of the tinge and in the area of the claws affected by the change) of the bright orange phases. The red colour invariably shows first at the tip of the claw, spreading toward its base.

(7) The change of colour of the fur is due to a change of colour in the pigment (from olive to orange), probably owing to oxidation. The fact that some individuals exhibit no colour phases at all, while others remain in an intermediate phase, may be due to absence of the oxidizing element or to some factor which wholly or partly neutralizes this element.

Explanation of plates.

By the "four colour process" employed it has only been possible to give an approximately correct idea of the true colours of the specimens figured.

All figures are about 3/5 natural size.

Fig. 1. ♀ ad., 18 October 1912, Seringapatam, S. Mysore, G.C.S. 1935, age, three and half years. Autumn moult beginning. The fur on the back of the neck and shoulder is purposely disarranged, to show the new dark coat coming up underneath (it looks in the figure, and, on hurried inspection, in the specimen as well, as if the orange hairs had dark bases; this is not the case; the orange fur is always uniform to its extreme base, or if anything lighter at base; what looks like dark bases is, of course, the new dark coat). The orange fur, being old and worn, has lost some of its brilliancy. Back between Sanford's brown and orange-rufous (II, 11, j), underparts nearly ochraceous-orange (XV, 15') with the new mouse-grey coat beginning to appear on throat, flanks, and anal region.

Fig. 2.—Same sex, date, place, and age as foregoing, G. C. S. 1938. Autumn moult well advanced. Old orange fur chiefly

confined on upperside to sides of back, on underside to chest and part of belly, though the new fur, both above and below, is still thinly sprinkled with old orange hairs. Several stages connecting those represented by figs. 1 and 2 have been seen, all from October.

Fig. 3.—Same sex, date, place, and age as foregoing, G. C. S. 1944. One of the final stages of the autumn moult. Old orange pelage now restricted on upperside chiefly to a narrow stripe on each side of the dorsum, along the lateral membranes, and on underside to a V-shaped patch on the chest; new fur on back still with a very thin admixture of old orange hairs; on belly a few tiny bunches of ochraceous-orange hairs among the new grey hairs. Several stages between "Fig. 2" and "Fig. 3" are in the collection, all from October.

Fig. 4.—♀ ad, 19th October 1912, same place, G. C. S. 1958, age, about a year and a half. Moult practically completed (faint traces of orange hairs behind the ears and on chest, but these are discernible only on very close examination). Upperside mouse-brown, *i. e.* a dark shade of brown approaching clove-brown (XL) or fuscous (XLVI), but finely powdered with greyish owing to the narrow grey tips to most of the hairs, these greyish tips being longest and most conspicuous on the shoulders and back of the neck; base of fur paler; underparts nearly uniform mouse-grey (paler than LI, 15'''). Similar specimens from October are in the collection, but none from any other month. The new "summer" fur (May) is probably of the same colour, but only specimens in the first stages of the spring moult have been seen.

Fig. 5.—♀ ad., 18th October 1912, same place, G. C. S. 1949, age, about six months. A perfectly full grown bat of the year (epiphyses of the metacarpals ossified). It had completed its first autumn moult, and was killed while the colour of its new coat was changing from mouse-brown to auburn above, and from mouse-grey to ochraceous-tawny on the underside of the body. This individual has been so fully dealt with in the text (p. 8) as to need no further description here. Notice the entirely different "pattern" of this specimen, both above and below, as compared with the moulting individuals, figs. 2 and 3.

Fig. 6.—♀ ad., 21 November 1911, Devikop, S. Mahratha Country, G. C. S. 138, age, about a year and a half. To show the perfectly developed auburn phase. There is now no trace of mouse-brown or mouse-grey in the coat. Upperside pale auburn (very nearly auburn Sanford's brown, II, 11, 1), gradually lightening (almost to cinnamon, XXIX, 15'') toward the base of the fur; underparts warm ochraceous-tawny (XV, 14', i). This phase begins to make its appearance immediately after the autumn moult, in October, but specimens from that month (five from Seringapatam,

S. Mysore) are either only half auburn (one, see fig. 5), or have at least some grey colour left on the throat, or both there and on the belly (the others). In the November material (Devikop, S. Maharashtra Country) the full auburn phase, as figured here, without trace of mouse-colour, is absolutely predominant; and the same phase occurs, though (so far as the material goes) much more sparingly, in the later months of the season. The summer fur (after the spring moult in May) will probably be found to have its corresponding auburn phase, but material from that season is lacking.

Fig. 7.—♀ ad, 18th January 1912, Potoli, S. E. of Supa, North Kanara, G. C. S. 528, age, about one year and nine months. To show an average tinge of the orange phase. Upperside almost orange-rufous (closely approaching II, 11, i), the tinge being slightly brighter and more glossy (II, 11, h) at the concealed base of the hairs; underparts almost ochraceous-orange (XV, 15' or 16). No specimens comparable with this have been seen from the month of October (except, of course, those moulting from the orange to the dark phase, in which, however, the orange has lost considerably in brilliancy); a few individuals from November (S. Maharashtra Country) approach it but do not quite match it in hue; no December specimens are available; in January this type of colour (or even brighter hues) is decidedly predominant and remains so till April and May, though in the latter month (spring moult) it has probably as a rule lost some of its brightness and gloss. The fact that the October series contains a good number of orange individuals in moult shows that the summer fur also has its orange phase.

Fig. 8.—Same sex, date, and place as fig. 7, G. C. S. 522, age, about nine months. The palest extreme of the orange phase. Upperside nearly xanthine-orange (III, 13, i or h), underparts pale yellow ochre (XV, 17' a). Quite or approximately similar individuals have only been seen from January to April. The summer fur of some individuals may change into similar hue.

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON.

REPORT No. 28. KALIMPONG (DARJILING).

BY R. C. WROUGHTON.

COLLECTION	...	...	No. 28.
LOCALITY	...	...	Kalimpong (Darjiling).
DATE	...	...	June-October 1916.
COLLECTED BY	...	...	N. A. Baptista.
EARLIER REPORTS	...	...	No. 1, East Khandesh, Vol. XXI, p. 392, 1912; No. 2, Berars. Vol. XXI, p. 820, 1912; No. 3, Cutch, Vol. XXI, p. 826, 1912; No. 4, Nimar, Vol. XXI, p. 944, 1912; No. 5, Dharwar, Vol. XXI, p. 1170, 1912; No. 6, Kanara, Vol. XXII, p. 29, 1913; No. 7, Central Provinces, Vol. XXII, p. 45, 1913; No. 8, Bellary, Vol. XXII, p. 53, 1913; No. 9, Mysore, Vol. XXII, p. 283, 1913; No. 10, Kathiawar, Vol. XXII, p. 464, 1913; No. 11, Coorg, Vol. XXII, p. 486, 1913; No. 12, Palampur, Vol. XXII, p. 684, 1913; No. 13, South Ceylon, Vol. XXII, p. 700, 1913; No. 14, Shan States, Vol. XXII, p. 710, 1914; No. 15, Kumaon, Vol. XXIII, p. 282, 1914; No. 16, Dry Zone, Central Burma and Mt. Popa, Vol. XXIII, p. 460, 1915; No. 17, Tenasserim, Vol. XXIII, p. 695, 1915; No. 18, Ceylon, Vol. XXIV, p. 79, 1915; No. 19, Bengal, Vol. XXIV, p. 96, 1915; No. 20, Chindwin, Vol. XXIV, p. 291, 1916; No. 21, Gwalior, Vol. XXIV, p. 309, 1916; No. 22, Koyna Valley, Vol. XXIV, p. 311, 1916; No. 23, Sikkim, Vol. XXIV, p. 468, 1916; No. 24, Sind, Vol. XXIV, p. 749, 1916; No. 25, Chin Hills, Vol. XXIV, p. 758, 1916; No. 26, Darjiling District, Vol. XXIV, p. 773, 1916; No. 27, Bhutan Duars, Vol. XXV, p. 63, 1917.

On completion of his work in the Bhutan Duars, reported in No. 27 (J., B. N. H. S., XXV., p. 63, 1917), Baptista, the Society's Collector, moved on to Kalimpong, where Dr. Sutherland had consented to supervise his movements. The present collection represents his work there during five months, June-October, 1916.

Unfortunately no notes on the topography are available, but I gather from the Gazetteer that Kalimpong is a tract in the Darjiling District, situated at about 27° N. Lat. and 88°30' E. Long., east of the Tista River, west of Ni-chu and Di-chu, and bounded by Bhutan on the north. The tract is made up of a series of steep ridges and the valleys between, and is largely under trees. The area is just over 400 sq. miles, of which slightly more than half is Reserved Forest, situated on the tops of the ridges and the bottoms of the valleys, i.e., above 5,000' and below 2,000'.

The fauna seems to be identical with that of Darjiling and the

Bhutan Duars, but the collection, though a fairly large one in numbers, has not a wide range in species.

In all there are some 560 specimens divided among 29 species and subspecies, in 22 genera.

There is nothing new to the Survey list in the collection, but the series of *Nyctalus* and *Barbastella* are most welcome, as so far only single specimens had been obtained.

(1) *ROUSETTUS LESCHENAULTI*, Desm.

The Fulvous Fruit Bat.

(Synonymy in No. 11.)

Pedong, ♂ 1 (juv), ♀ 5.

(See also Reports Nos. 15, 16, 17, 22 and 27.)

(2) *RHINOLOPHUS ROUXI*, Temm.

The Rufous Horse-shoe Bat.

(Synonymy in No. 5.)

Nimbong, ♂ 6.

(See also Reports Nos. 6, 9, 13 and 15.)

(3) *RHINOLOPHUS MONTICOLA*, K. And.

The Mussoorie Horse-shoe Bat.

(Synonymy in No. 20.)

Nimbong, ♂ 2, ♀ 12; Pedong, ♀ 1; Sangser, ♂ 3.

(4) *HIPPOSIDEROS AEMIGER*, Hodgs.

The Great Himalayan Leaf-nosed Bat.

(Synonymy in No. 14.)

Nimbong, ♀ 2.

(See also Reports Nos. 15, 16, 20, 25 and 26.)

(5) *HIPPOSIDEROS FULVUS*, Gray.

The Bicoloured Leaf-nosed Bat.

(Synonymy in No. 3.)

Nimbong, ♂ 5, ♀ 12; Sangser, ♂ 6, ♀ 9.

(See also Reports Nos. 3, 5-10, 12-14, 16-20, 22-24 and 27.)

(6) *BARBASTELLA DARJELINGENSIS*, Horsf.

The Eastern Barbastel.

(Synonymy in No. 26.)

Nimbong, ♂ 6, ♀ 12.

(See also Report No. 27.)

(7) *TYLONYCTERIS FULVIDA*, Blyth.

The Club-footed Bat.

(Synonymy in No. 26.)

Kalimpong, ♂ 6, ♀ 15; Nimbong, ♂ 1; Sangser, ♂ 1.

(See also Reports Nos. 14, 17, 20, 23 and 25.)

(8) NYCTALUS LABIATUS, Hodgs.

The Indian Noctule Bat.

Sangser, ♂ 2, ♀ 8.

This animal at first sight looks like a *Scotophilus*, but is at once recognisable by the very short fifth finger. A naked spot between the shoulders is so constantly present as to be a character of almost specific value.

(9) PIPISTRELLUS COROMANDRA, Gray.

The Coromandel Pipistrel.

(Synonymy in No. 5.)

Nimbong, ♂ 2, ♀ 1; Pedong, ♂ 12, ♀ 26; Kalimpong, ♂ 2, ♀ 1; Sangser, ♂ 1.

(See also Reports Nos. 2, 5, 9, 11, 13-15, 19, 23, 26 and 27.)

(10) MURINA TUBINARIS, Scully.

Scully's Tube-nosed Bat.

(Synonymy in No. 25.)

Sangser, ♂ 3.

(See also Report No. 26.)

(11) MURINA CYCLOTIS, Dobs.

The Round-eared Tube-nosed Bat.

(Synonymy in No. 23.)

Sangser, ♂ 1.

(See also Reports Nos. 25 and 26.)

(12) TUPAIA BELANGERI CHINENSIS, And.

The Assam Tree Shrew.

(Synonymy in No. 23.)

Nimbong, ♂ 2.

(See also Report No. 27.)

(13) SORICULUS CAUDATUS, Horsf.

Hodgson's Brown-toothed Shrew.

(Synonymy in No. 15.)

Sangser, ♀ 2.

(See also Reports Nos. 23, 26 and 27.)

(14) PACHYURA SP.

The Musk-rat.

Kalimpong, ♂ 15, ♀ 26; Nimbong, ♂ 2; Pedong, ♂ 5, ♀ 5; Sangser, ♂ 1.

(See also Reports Nos. 1, 3-7, 9-13, 15-19, 22, 23, 26 and 27.)

(15) FELIS AFFINIS, Gray.

The Jungle Cat.

(Synonymy in No. 1.)

Nimbong, ♀ 1.

(See also Reports Nos. 3-7, 10-12, 15, 16, 18-20, 22, 24 and 27.)

(16) *FELIS (domestic)*.

Pedong, ♂ 1.

(17) *VIVERRA ZIBETHA*, L.

The Large Indian Civet.

(Synonymy in No. 14.)

Nimbong, ♂ 1, ♀ 1.

also Reports Nos. 20, 23, 25, 26 and 27. Nos. 14 and 17, separated as sub-species *pruinosa*.)

(18) *CANIS INDICUS*, Hodgs.

The Bengal Jackal.

(Synonymy in No. 5)

Pedong, ♂ 1, ♀ 1.

(See also Reports Nos. 14-16, 19, 20, 23, 25 and 27.)

(19) *MARTES FLAVIGULA*, Bodd.

The Northern Indian Marten.

(Synonymy in No. 15.)

Pedong, ♀ 1.

(See also Reports Nos. 20, 23, 25 and 27.)

(20) *LUTRA LUTRA*, L.

The Common Otter.

(Synonymy in No. 11.)

Pedong, ♀ 1. (no skull.)

(See also Reports Nos. 15, 18 and 23.)

(21) *RATUFA GIGANTEA*, McCl.

The Assam Giant Squirrel.

(Synonymy in No. 14.)

Sangser, ♂ 2, ♀ 1.

(See also Reports Nos. 23 and 26.)

(22) *TOMEUTES LOKEOIDES*, Hodgs.

The Hoary-bellied Himalayan Squirrel.

(Synonymy in No. 23.)

Nimbong, ♂ 1; Sangser, ♀ 2.

(See also Reports Nos. 23, 26, and 27.)

(23) *VANDELEURIA DUMETICOLA*, Hodgs.

Hodgson's Tree Mouse.

(Synonymy in No. 16.)

Kalimpong, ♂ 1.

(See also Reports Nos. 23, 25, 26 and 27.)

(24) *MUS DUBIUS*, Hodgs.

The Nepal House Mouse.

(Synonymy in No 15.)

Kalimpong, ♂ 18, ♀ 28; Nimbong, ♂ 1; Pedong, ♂ 5, ♀ 12.

(See also Reports Nos. 23, 26 and 27.)

(25) *MUS HOMOCERUS*, Hodgs.

The Himalayan House Mouse.

(Synonymy in No. 15.)

Kalimpong, ♂ 6, ♀ 2; Nimbong, ♂ 2, ♀ 1; Pedong,
♂ 12, ♀ 14; Sangser, ♂ 1, ♀ 1.

(See also Reports Nos. 23, 26 and 27.)

(26) *MUS PAHARI*, Thos.

The Sikkim Hill Mouse.

(Synonymy in No. 23.)

Pedong, ♀ 1 (juv); Sangser, ♀ 1.

(See also Report No. 26.)

(27) *RATTUS FULVESCENS*, Gray.

The Chestnut Rat.

(Synonymy in No. 15.)

Nimbong, ♂ 2, ♀ 1; Pedong, ♂ 1, ♀ 2.

(See also Reports Nos. 14, 17, 23, 25 and 26.)

(28) *RATTUS NITIDUS*, Hodgs.

Hodgson's Grey-bellied Rat.

(Synonymy in No. 15.)

Kalimpong, ♀ 1; Nimbong, ♂ 6, ♀ 1; Pedong, ♂ 1, ♀ 1,
Sangser, ♂ 3, ♀ 3.

(See also reports Nos. 23 and 26.)

(29) *RATTUS FULVESCENS*, Gray.

The Common Indian Rat.

Variety with white underside:—

Kalimpong, ♂ 17, ♀ 14; Nimbong, ♂ 28, ♀ 31

Pedong, ♂ 30, ♀ 21; Sangser, ♂ 18, ♀ 14.

(30) *GEOMYS BENGALENSIS*, Gr. and Hardw.

The Bengal Mole Rat.

(Synonymy in No. 19.)

Kalimpong, ♂ 1, ♀ 1; Nimbong, ♂ 5, ♀ 9.

(See also Reports Nos. 20, 23, 26 and 27.)

LIVERWORTS OF THE WESTERN HIMALAYAS AND THE
PUNJAB, WITH NOTES ON KNOWN SPECIES AND
DESCRIPTIONS OF NEW SPECIES.

BY

SHIV RAM KASHYAP, M.Sc. (Punjab), B.A. (Cantab.),

Professor of Botany, Government College, Lahore.

II.

MARCHANTIALES—(concluded).

(Continued from page 350 of Vol. XXIV.)

Fimbriaria reticulata, n. s. Dioecious. Thallus yellowish green, thin, unbranched, upto 6 mm. long and 4 mm. broad, obovate with a deep notch at the apex. Margins entire. Dorsal surface flat. Stomata not prominent, each bounded by one ring of 6-7 cells; air chambers empty in two layers. Ventral surface greenish; scales purple ovate, appendage ovate entire. Midrib broad, elliptic—oblong in transverse section, slightly projecting ventrally, rather suddenly passing into the wings. Carpocephalum—stalk naked reddish at base upto $4\frac{1}{2}$ mm. long; receptacle flat, stomata only slightly raised sporogonia upto 4; pseudo-perianth hyaline, 3 exserted. Spores, elaters and antheridia not seen. The apical part of the thallus in sterile plants becomes narrowed and thickened, and persists in this condition through the dry period.

Habitat.—Kashmir, 8,000 ft. in a shady place along the road.

Plagiochasma simlensis, n. s. Dioecious or monœcious. Thallus closely creeping, bluish green, branched, upto 15 mm. \times 4 mm. Margins entire or slightly crenulate. Dorsal surface smooth, plane; stomata not at all prominent, very small, pore minute bounded by 4 or 5 cells; upper epidermis thin walled, trigones small. Ventral surface purple; scales overlapping, triangular, entire, appendage not sharply constricted off from the body, purple or hyaline. Transverse section of the thallus biconvex in the middle gradually thinning towards the margins. Female receptacle sessile or shortly stalked (stalk when present upto 2 mm.), concave dorsally. Sporogonia 1 or 2. Spores broadly reticulate-lamellate; margin spinulose; about 112 u. Elaters closely 3-4-spiral, broad large, occasionally branched, 340-400 u. Male receptacles in a middorsal row, either on different lobes of the thallus bearing female receptacles or on different plants, cushion like, circular or notched anteriorly.

Habitat.—Simla, below Chota Simla, near a small stream, August. The "æstivation" of the involucre is similar to that of other species described by the writer before, (New Phytologist, Vol. XIII, No. 9), one valve being folded and the other being fully opened out.

Jungermanniales.

Riella indicast., n. s. Plants submerged erect or ascending, firmly fixed to the mud by rhizoids, often in dense patches, light green, simple or once or twice forked, upto 10 mm. long. Often many branches are given off from the base and plants have a tufted habit. Wing well developed in early stages upto 2 mm. broad; in the fertile portion small and interrupted, lateral leaves long and narrow, linear, conspicuous. Involucres upto 6 on each plant, densely situated, cylindrical pointed upto 2 mm. long, cells papiliform. Spores reticulate spinous, 7-8 reticulations in the diameter, spines conspicuous projecting beyond the margins.

Fossombronia himalayensis, Kashyap. (New Phytologist, XIV, No. 1). Mussoorie; Chamba-Pangie road; Simla. The wingless terminal stalk-like portion bearing the tuber at the apex often divides into two branches each bearing one tuber exactly as in *Sewardiella tuberifera* (see below). July-September.

Sewardiella tuberifera, Kashyap. (New Phytologist, XIV, No. 1). It may be taken to be a condensed form of *Fossombronia himalayensis*. July-September.

N.B.—The leafy *Jungermanniales* will be taken up later on.

Anthocerotales.

Anthoceros himalayensis, Kashyap. (New Phytologist, Vol. XIV, No. 1).

Habitat.—Many parts of the Himalayas; Simla; Mussoorie; rarely on the banks of the Ravi in Lahore. Plant growing under water or where they are constantly moistened by dripping water do not form the characteristic tubers. July-September. (In Lahore about March).

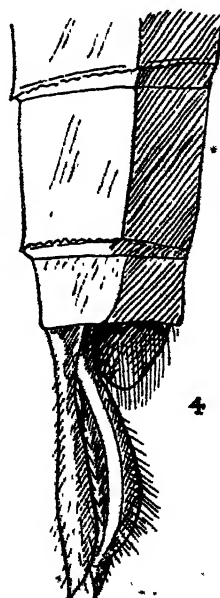
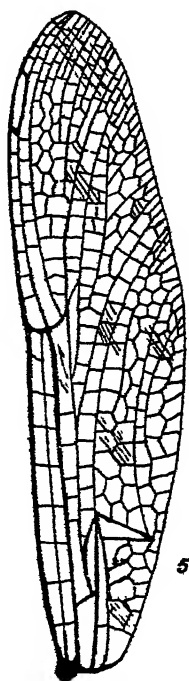
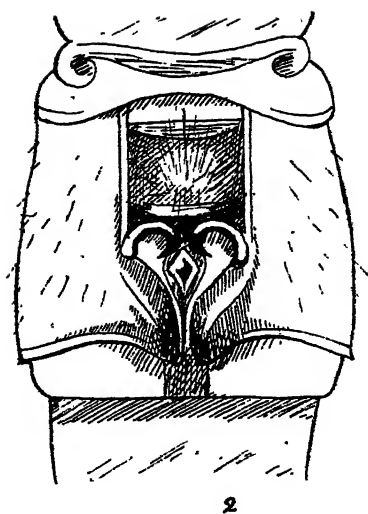
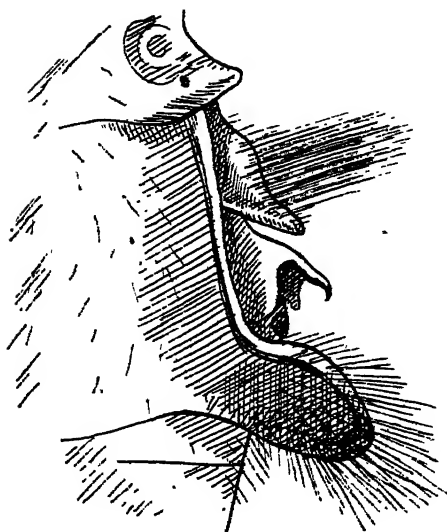
Anthoceros erectus, Kashyap. (New Phytologist, Vol. XIV, No. 1). Mussoorie, Simla. July-September.

Anthoceros chambensis n. s. Thallus closely creeping firmly fixed to the soil, in dense circular or irregular patches, lobes often overlapping, margin toothed slightly raised upwards. Patches upto 3 cm. or more in diameter. Lobes thick fleshy with large mucilage cavities inside; greatest thickness in the middle upto 16 cells; upto 1 cm. broad. No distinct midrib. Epidermal cells 32 m. \times 20 m. Rhizoids mostly smooth, some granular. Dioecious. Involucre tubular narrowed above, with truncate mouth; 2.5 mm. Sporogonia 2.5 cm. long, solitary. Pseudoclasters thin walled usually branched, upto 100 u. long, slender. Spores opaque faintly granular, 40-48 u. Male plants not seen.

Habitat.—Chamba-Chauri road, moist rock; sterile plants were also found by the late L. Bashambar Das near Sialkot.

Notothylas levieri, Schffr. Plants densely overlapping in small thick patches, ascending, fixed only at the base; patches projecting outwards from vertical rocks. Thallus thin, delicate, largest circular in outline upto 1 cm. in diameter; smaller plants usually obovate; margin lobed, lobes narrow, small, toothed; Nostoc colonies scattered. Greatest thickness upto 6 cells in the middle gradually thinning towards the margins. Dioecious. Sporogonia marginal between the lobes equal to or smaller than the full grown adjacent lobes, entirely within the involucre which often arise in pairs; upto 2 mm. long \times $\frac{1}{2}$ mm. broad. Epidermis without stomata; radial walls of epidermal cells very thick and brown, cavity very narrow; epidermal cells 90-110 u. \times 18-20 u. Spores opaque dark brown, minutely granular, 36 u. Sterile cells with oblique curved thin bands or incomplete spirals, 45 u. \times 22-40 u.

Habitat.—Simla; Mussoorie July-September.



GENITAL ORGANS AND WING OF THE DRAGON FLY.

BRACHYTHEMIS FUSCOPALLIATA.

arc in forewing about midway between antenodal nervures 1 and 2 : one or two very incomplete rows of cells in the space between the subnodal sector and the supplementary sector of forewing. Stigma bright opaque yellow. Costa brown, reddish brown in its outer third. A broad, blackish-brown fascia crossing both wings from the base to 2 postnodal cells in the forewing and 3-4 in the hind, in which its free border slopes obliquely to meet the termen at about its middle.

Anal appendages.—Ochreous, the superior long, about or a little less than the length of 9th and 10th abdominal segments, pubescent, cylindrical and pointed. The inferior fused to form a triangular body, notched slightly at the extremity.

Sexual organs.—L. a. recumbent, on its surface two tufts of long, greyish cilia. Hamecons very small, anterior as two, small, strongly-arched, slim hooks ; posterior, low and blunt : lobe moderately large, rounded and projecting somewhat more than the hamecons.

Female.—Morphology except for the anal appendages and sexual organs and a few points in the wings, similar to the male.

Head.—Eyes olivaceous with 2 dark-brown lines traversing them from above downwards, to half-way down the sides, the anterior of these bands starting from the apex of the occipital triangle. Clypeus, epistome, vesicle, occiput and labium and labrum, all light greenish-yellow.

Prothorax lemon-yellow with two transverse, black streaks.

Thorax olivaceous-green with a triplicated humeral fascia : the thoracic spiracle and lateral sutures black.

Legs yellow, streaked in their length with black. Spines similar to male.

Wings.—Antenodal nervures $8\frac{1}{2}$ - $7\frac{1}{2}$, the final one complete or incomplete, this lack of symmetry sometimes seen in the opposite wings of a single specimen, and some of the nervures often bifurcating in the costal space. Trigone in forewings traversed by one nervure ; only one row of cells in the space between the subnodal sector and the supplementary nervure. The black fascia found in the male, entirely absent in the female : the antenodal nervures bright yellow as is also the pterostigma.

Anal appendages ochreous, tipped with black, widely separated, cylindrical, nearly as long as in the male, straight.

Sexual organs.—Vulvar scale, two triangular, stout organs, slightly separated with concave, opposing borders and a minute point at their extremities.

Abdomen olivaceous-green with a black, mid-dorsal line and a brown, subdorsal fascia : the edges, narrowly black. Extent of markings variable, in some these preponderating over the ground colour and in juvenile specimens, the latter preponderating.

Expanse 62 mm. Length 85 mm. Pterostigma 2.5.

THE CONE OF *SELAGINELLA PALLIDISSIMA*, SPR.

BY

S. L. GHOSE, M.Sc..

Assistant Professor of Botany, Government College, Lahore.

(With a plate.)

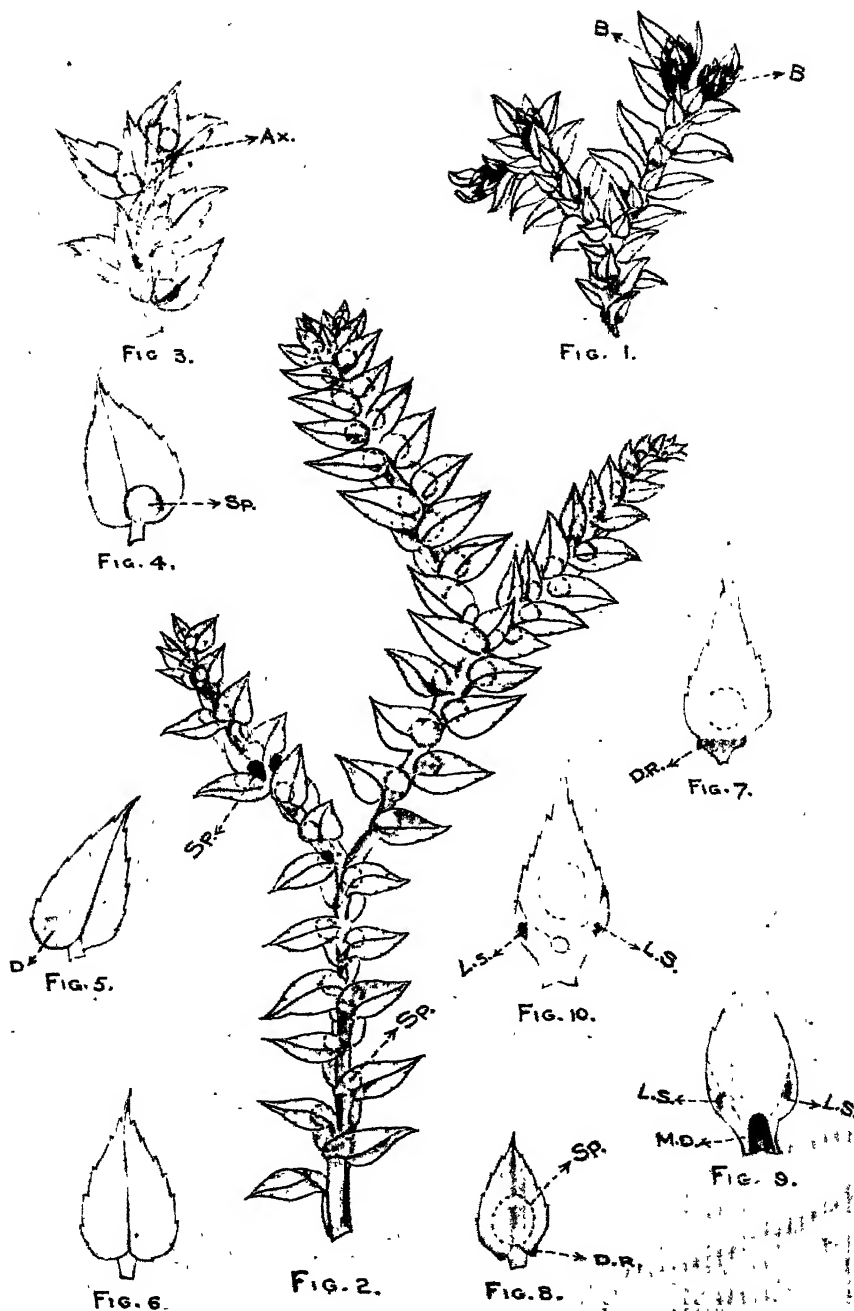
In this paper the writer proposes to describe the cone of *Selaginella pallidissima*, not so much its internal structure as some points about its external morphology such as its size, and the form of its sporophylls, especially in relation to their protection of sporangia. Besides, a comparison between its sporophylls and those of the cones of some other species of the genus is attempted with regard to their protection of sporangia.

A paper on 'The Cones of the Genus *Selaginella*' was published in the 'Annals of Botany' in July 1910 by Miss M. G. Sykes and Mr. W. Stiles, where also the different kinds of sporophylls were described in relation to their protection of sporangia, but the peculiar conditions found in the species *S. pallidissima*, were not noted (9).

The material of *S. pallidissima*, *S. chrysocaulos*, and *S. chrysorrhizos* was collected by Professor Shiv Ram Kashyap of the Lahore Government College and the writer at Simla at a height between 5,000 and 7,000 feet above the sea level. Part of it was preserved in alcohol, and the rest dried up. *S. serpens*, *S. Emmeliana*, and *S. reticulosa* were obtained fresh from the Lahore Botanical Gardens. *S. spinosa*, *S. Martensii* and *S. kraussiana* were obtained as preserved material from England.

GENERAL.

There are two species of the genus *Selaginella* with the species *S. pallidissima* which have a peculiar habit of life. The ordinary leaves are of two kinds, the lower leaves being sterile and the upper leaves being 'fertile' (1). There is only one more species, *S. ciliosa*, in the genus. The latter is found in Ceylon. Gabel in his 'Organography of Plants' puts these two species in the group 'Platystachyes' with the 'first kind of flowers'; the second kind of 'flowers' being 'inverse-dorsiventral' (5). He is of the opinion that in the second kind of 'flowers', 'the larger sporophylls are situated upon the upper surface of the axis form a protective cover to the smaller ones' and this—as well as the increased capacity of assimilation of the upper leaves—is, to speak teleologically, the reason why the 'flowers' of the upper surface are different from the foliage leaves. Thus he explains the rarity of the first kind of 'flowers' and that the 'inverse-dorsiventral flowers' are more numerous in the species *S. pallidissima*. Therefore, in the study of the cone of *S. pallidissima*, a very interesting, especially with regard to its external morphology, is the cone, and the sporophylls of the cone, and their relation to the sporangia.



THE CONE OF *SELAGINELLA PALLIDISSIMA*, SPR.

(For Explanation of Figures, see end of article.)

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reproduction in some Indian Selaginellas' has described 'surface-tubers' in *S. chrysocaulos*, which provide for vegetative propagation in that species (2). The buds in *S. pallidissima* are much smaller, though quite as compact as those of *S. chrysocaulos*. The writer has not been able to find any beginnings of rhizophores in them, so that he cannot say whether or not these correspond to the 'surface-tubers' of *S. chrysocaulos*. He thinks that they might be of the nature of 'winter-buds' of the higher plants, which simply protect the growing apex from inclement weather.

THE CONE.

The cone generally forms a branched structure up to 5 cm. long (Fig. 2). Baker, however, gives $\frac{3}{4}$ -1 inch as the size of the cone (1). This is due, perhaps, either to his not recognizing the branched nature of the cone, or his examining only very small specimens. The branched nature is clearly proved by the presence of sporangia in the whole of the branched structure (Fig. 2). Besides, it is not uncommon to find individual fertile branches measuring about 3.5 cm. in length. The sporophylls are not situated very compactly on the axis, but are placed at a little distance—about .6 mm. in the lower and .75 mm. in the upper sporophylls—from each other, so that portions of the axis lying between the consecutive leaves are clearly visible through the upper sporophylls (Fig. 3, ax). The sporangia, as a rule, lie in the axil of the sporophylls of the lower plane only, the upper sporophylls being generally sterile. This peculiarity is very interesting, because as far as the writer could find out it is supposed that in the genus *Selaginella* each of the sporophylls, except sometimes the basal ones, has a sporangium in its axil. Miss Mitchell in her paper on 'The Anatomy of the Genus *Selaginella*' writes, 'The leaves,' meaning those of the cone, 'are hollowed to accommodate the sporangia which arise one in the axil of each leaf' (8). Bower in his book 'The Origin of a Land Flora' says: 'In fact its (of sporangium) position may vary in different species, though the numerical relation of one to each leaf is strictly maintained' (3). These assertions might mean that only one sporangium—not two or more—is found in the axil of each sporophyll, or that each sporophyll bears a sporangium in its axil. Miss Mitchell actually says that in the elongated cones of *S. helvetica*, *S. Wallichii*, *S. oregana* and *S. flabellata* the middle region is frequently sterile (8). Campbell, however, clearly writes on this point that 'the basal leaves of the strobilus may be sterile, but usually each sporophyll subtends a sporangium' (4). In all the species which the writer examined, except *S. pallidissima* each sporophyll did subtend a sporangium. The total absence of the sporangia from the axil of the upper sporophylls, therefore, becomes very characteristic.

The distribution of sporangia on the cone is usually indiscriminate, the megasporangia not always being confined to the basal regions. In number the latter are comparatively fewer than the microsporangia. A megasporangium on an average measures .8 mm. across, and a microsporangium .65 mm. along the long axis, the latter being 'saddle-shaped'.

Inequality in the size of mega-spores is also not uncommon, sometimes the whole cone having its megasporangia each containing two large and two small megasporoes. The megaspore ordinarily measures about .35 mm. across, but in cases of inequality of spores, the big megaspore measures about .4 mm. and the small one about .2 mm. in diameter. The microspore measures about .01 mm. across. The colour of megasporangia is yellow and that of microsporangia brownish red.

The sporophylls are dimorphous and 'homostachous'. Those of the lower plane are ovato-cordate, erecto-patent, shortly ciliated and slightly

imbricated, measuring about 1.7 mm. in length and 1 mm. in breadth (Figs. 4 & 5). The long axis of each sporophyll is at an angle of about 60° to that of the stem bearing it (Fig. 3). The sporophyll is clearly oblique; the half nearest the stem-axis is much bigger than the one away from it, and is besides much more lengthened out, and rounded at the base than the other half (Figs. 4 & 5). This stretched out portion partly goes under the stem-axis, and has a depression for lodging the sporangium. The rest of the sporophyll is quite flat and there is no dorsal flap or ridge at all as described by Sykes and Stiles in the species *S. pumila*, *S. helvetica*, and *S. caulescens* (9).

The sporophylls of the upper plane are cordate, patent, slightly ciliated and much imbricated (Fig. 6). Each is shortly stalked and measures about 1.3 mm. in length and 1 mm. in breadth; thus it is comparatively broader in form than the sporophyll of the lower plane. Its long axis is at an angle of about 30° to that of the stem (Fig. 3). It is quite flat and symmetrical and there is no dorsal flap or ridge.

The protection of sporangia is very characteristic in this species. They generally arise in the axils of sporophylls of the lower plane only. Each sporangium is lodged in the depression found in the stretched out basal part of the sporophyll as mentioned above. The upper surface of the sporangium is covered partly by the stem and partly by a portion of that half of the next higher sporophyll of the upper surface which is away from the axis. This is made possible by the sporophylls of the two planes being inserted at different angles to the stem-axis as noted above. The greater part of the upper sporophyll simply spreads over the stem, while the greater part of the lower ones spreads out free from the stem; thus the greater part of both kind of sporophylls is easily accessible to light for assimilation. The sporangium is placed between the overlapping portions (Fig. 3). In this way each sporangium is, as it were, enclosed, in a chamber formed by the basal parts of the lower and upper sporophylls and a portion of the stem. This form of sporangium-protection gives another reason why definite sterilizations are taken to be utilitarian. One reason is given by Miss Mitchell who says that these sterilizations 'make for the increased efficiency of the spore production as a whole' by preserving 'the balance between the spore producing and the vegetative parts' (8). The additional function of protecting the sporangia can also clearly be attributed to the sterile sporophylls of *S. pallidissima*. Here the laminas of two sporophylls, both practically flat, take part in the protection of one sporangium.

GENERAL CONSIDERATIONS.

The chief peculiarities in the cone of *S. pallidissima* can be summed up as its comparatively great size, branched nature, loose insertion of sporophylls, very little difference between the sporophylls and the ordinary vegetative leaves in structure and form, indiscriminate distribution of mega- and micro-sporangia, occasional inequality of size in mega-spores, saddle-shaped micro-sporangia, absence of sporangia from the axils of upper sporophylls, and the peculiar method of protection of sporangia by the sporophylls. The great size, branched nature, and loose insertion of sporophylls clearly show that the cone is not much highly advanced towards 'flower' formation. Indiscriminate distribution of mega- and micro-sporangia also tends to show the same according to Mitchell (8). A transverse section of the stem shows that the species belongs to *S. Martensii* group of Harvey-Gibson, which is taken as a primitive form of stem structure in the genus *Selaginella* (6). The stem is

mono-stelic and ribbon-shaped with two protoxylem groups, one at each end. Further, according to Sykes and Stiles the saddle-like shape of micro-sporangia also indicates the primitiveness of the cone (9). Then again, the 'homostachous' arrangement of sporophylls also proves the same fact (5). Thus it can be easily concluded that *S. pallidissima* is one of the simplest of the dorsiventral species of *Selaginella*. Sterilization of upper sporophylls, however, seems to show that the cone is not so primitive as it otherwise appears to be. The line of sterilization in this species is quite different from that of other species. Sterilization in other species begins from the base of the fertile branches and proceeds towards the apex; but in *S. pallidissima* sterilization takes place in the sporophylls of the upper plane only. In this connection it is interesting to note that Professor Kashyap informs the writer that he in very rare cases actually found one or two sporophylls of the upper surface having sporangia in their axils, forming as it were an intermediate stage. As already pointed out, this kind of sterilization is utilitarian, because it helps in the protection of sporangia besides preserving 'the balance between the spore producing and the vegetative parts.' This also explains the fact why the cone has a loose nature and is much bigger than that of most of the other species.

The peculiar arrangement for the protection of sporangia and specially the absence of any dorsal flap in the sporophylls becomes interesting in view of the assertion of Sykes and Stiles, who believe that the enfolding of the sporangia by the associated sporophyll is higher than the dorsal flap arrangement (9). For this purpose the cones of the following species were also examined to see the nature of dorsal flap in their sporophylls:—

I. Radial Cones—

- (a) *S. spinosa*, P. B. Aethog., has a very slight dorsal swelling.
- (b) *S. Emmeliana*, Van Geert., and *S. reticulosa*, Klot., have a slight dorsal ridge (Fig. 7).
- (c) *S. serpens*, Spr., has a better developed dorsal ridge with lateral prominences (Fig. 8).
- (d) *S. Martensii*, Spr., has better formed lateral projections on the dorsal ridge.
- (e) *S. kraussiana*, A. Br. (Figs. 9 & 10) has a very well formed dorsal flap, with a depression in the middle and a prominence at each side with a socket in each, in which the sporangium from below fits. The sporangium vertically below the sporophyll fits in the middle depression.

II. Dorsiventral Cones—

(a) In *S. chrysocaulos*, Spr., the smaller sporophylls, that is those of the lower plane, have a shallow depression at the base, and a big free dorsal transverse wing, a little notched in the middle. The bigger sporophylls or those of the upper plane are a little folded and have a long dorsal flap along its long axis, as figured in Goebel's 'Organography of Plants,' Vol. II, page 507 (5). Besides, each has a transverse dorsal ridge prominent at one side, namely, that under the stem. This little projection takes part in protecting the sporangium of the lower plane, situated just below the sporophyll. The sporangium is thus protected by the associated sporophyll, projecting from the higher sporophyll of the upper plane, and the dorsal transverse flap of the higher sporophyll, of the lower plane.

(b) *S. chrysorrhizos*, Spr., has the same conditions in the sporophylls as *S. chrysocaulos* except that the upper sporophylls have a better formed dorsal transverse ridge, and also that the lower sporophylls have a bigger dorsal flap with no notch in the middle.

It is interesting to note that according to Hieronymus these species make an ascending series (7). Thus the series of the radial cones would be

arranged as *S. spinosa*, *S. Emmeliana*, *S. viticulosa*, *S. serpens*, *S. Martensii* and *S. kraussiana*; and that of the dorsiventral ones as *S. pallidissima*, *S. chrysocaulos* and *S. chrysorrhizos*. It has been seen that the above series show the serial grades in the development of the dorsal flap of the sporophylls. It seems probable, therefore, that the dorsal flap has been evolved over again, in the genus *Selaginella*, and not inherited from ancestors resembling *Lycopodium*, as suggested by Sykes and Stiles (9). It is quite possible that it is produced on account of the gradual compactness of the cone, and the consequent compression brought on the sporophylls. Besides, the better protection of sporangia obtained by the dorsal flap arrangement also suggests that the possession of a dorsal flap by the sporophylls is more advanced.

SUMMARY.

The cone of *Selaginella pallidissima* is a branched structure up to 5 cm. in length. The sporophylls are very little differentiated from the ordinary vegetative leaves and are inserted quite loosely on the axis, so that the cone does not at all form a separate compact structure. The sporophylls of the upper plane are quite sterile and only those of the lower plane have sporangia, one in the axil of each sporophyll. Mega- and micro-sporangia are distributed indiscriminately on the cone. Sometimes mega-spores are unequal in size. Microsporangia are 'saddle-shaped.'

The cone can be taken to be a very primitive one on account of its big size, branched nature, loose insertion of sporophylls, little differentiation of the latter from ordinary foliage leaves, and indiscriminate distribution of mega- and micro-sporangia on the axis. The absence of any dorsal flap or ridge on the comparatively simple sporophylls of *S. pallidissima* and a comparison of the more complex sporophylls of *S. spinosa*, *S. Emmeliana*, *S. serpens*, *S. Martensii*, *S. kraussiana*, *S. chrysocaulos* and *S. chrysorrhizos*, tend to show that the presence of the dorsal flap in the sporophylls of *Selaginella* is not primitive, but has been evolved in the genus.

The writer's cordial thanks are due to Professor Shiv Ram Kashyap for kindly allowing him to use his material and for many corrections and suggestions in the paper.

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EXPLANATION OF THE FIGURES.

Figure 1—A small branch of *S. pallidissima* to show vegetative buds at B. (\times by 5).

Figure 2—A whole branched cone of *S. pallidissima*, seen from the lower surface. Sp. sporangium. (\times by 5).

Figure 3—A small portion of the cone of *S. pallidissima*, seen from above. Ax. stem-axis, seen through the upper sporophylls. (\times by 8).

Figure 4—Left hand sporophyll of the lower plane of *S. pallidissima*. Sp. sporangium. (\times by 20).

Figure 5—Right hand sporophyll of the lower plane of *S. pallidissima*. D. depression for the sporangium. (\times by 20).

Figure 6—Right hand sporophyll of the upper plane of *S. pallidissima*. (\times by 20).

Figure 7—Sporophyll of *S. Emmetiana* seen from the dorsal side. D. R. dorsal ridge. (\times by 20).

Figure 8—Sporophyll of *S. serpens*, seen from the dorsal side. (\times by 20).

Figure 9—Sporophyll of *S. kraussiana*, seen from the dorsal side. M. D. middle depression; L. S. lateral sockets. (\times by 20).

Figure 10—Sporophyll of the same, seen from above. L. S. lateral sockets. (\times by 20).

PRELIMINARY NOTES ON A RECENT BOTANICAL TOUR TO THE HIGH WAVY MOUNTAIN (S. INDIA).

BY

E. BLATTER, S. J., AND PROF. F. HALLBERG.

Early this year we asked Major Gage, the Director of the Botanical Survey of India, to suggest a spot which was not known botanically. It so happened that he was just touring in S. India, looking out for land suitable for cinchona plantations, and he had visited the higher levels of most mountains of S. India. He advised us to pay a visit to the High Wavy Mountain, provided we were ready to rough it. As to the latter point there was not the slightest reluctance on our part; but before we start on a tour, we always like to know, at least approximately, the geographical position of the country to be visited. So far we knew we had to go south; but this was about all. We consulted the Imperial Gazetteer, but the High Wavy Mountain was not to be found, and the sheets of the Atlas volume are not on a sufficiently large scale to contain many of those multi-syllabic names of the Tamil language. We procured the latest Survey maps of S. India, and on one of them we came across the name of the High Wavy Mountain. But the contours were not given. There was only a blank space with the following words printed in it: "High Wavy Mountain, forming the source of the Shurly, overrun with dark impenetrable forest." That much at least was sure that the mountain in question was situated in the south-western corner of Madura District, on the frontier of Travancore. We expected more detailed information from the District Gazetteer of Madura: but we were sadly disappointed. The essence of all the information derived from it may be expressed in the Gazetteer's own words: "The High Wavy is the least known part of the hills of Madura, and is infested with elephants." If Major Gage had not indicated the route we had to take, I am afraid we should still be in search of the High Wavy Mountain. We left Bombay at the beginning of May, accompanied by Mr. Almeida, Assistant Professor of Biology at St. Xavier's College, who was expected to pay special attention to the ferns, Mr. Prater of the Bombay Natural History Society who was sent as collector for the Mammal Survey, and Mr. Vakil who intended to collect the fungi and lichens of that area. In Madras we made a last attempt to get a good map of the country we were to examine. All we were able to procure was the Madura District map (without hills) for the use of touring Officers. We continued our railway journey down to Ammayanyakkanur, perhaps better known under the name of Kodaikanal Road Station. Here we bought our provisions: a sack of rice, flour, salt, pepper, coffee and sugar. We had to do 60 miles in a bullock cart before we could expect to reach Kambam, a small town at the foot of the High Wavy. Our road first went due west to Periyakulam, a town south of the Palni Hills. From there we entered the Kambam Valley in a south-western direction, walled in on both sides by high precipitous mountains. To the right we had the continuation of the Palni Hills, the so-called Cardamom Hills, and to the left the Varushanad and Andipathi Range, an outlier of the Western Ghats. We did the journey in 24 hours, without a break. We were not sorry when we arrived at Kambam and were allowed to have a day's rest at the Forest Ranger's Office, which Mr. Jackson, the Conservator of Forests, had kindly put at our disposal.

To the east of Kambam a beautiful waterfall is visible in the upper third of a high mountain. This was pointed out to us as the river that drains the High Wavy. At last we had got a glimpse of the mountain that nobody

seemed to know. It rose before us, steep and precipitous. We were told that a forest road leads up to the top, where a forest hut would be ready to receive us. We decided to start early next morning. But it was not going to be early, owing to the late arrival of the coolies. It was a stiff climb of ten miles in the scorching heat of the sun, with no food and with very little and bad water. All our scientific interest was gone and we did not care a straw for plants during those hours, and I made up my mind never to go in for botany in future. It was only later on during our descent that we noticed that the lower slopes are well covered with deciduous forest. The lower region contains a *Cycas*, one or two species of *Phoenix*, *Anogeissus latifolia*, *Adina cordifolia*, *Dalbergia paniculata*, *Pterocarpus marsupium*, *Schleichera trijuga*, and other marketable timber trees, and also the rare *Aquilaria agallocha*, the "scented eagle wood" of commerce. The upper part of the deciduous zone produces blackwood (*Dalbergia latifolia*), *Lagerstœmia microcarpa*, and some teak of fair size. Above the deciduous zone there follows a belt of bare, rocky grass land. The top of the hill consists of an undulating plateau, perhaps 15 square miles in area, which is entirely covered with a continuous, dense evergreen forest which runs down in long irregularly shaped masses for a considerable distance into the valleys on either side. It was in this part of the mountain, at about 5,100 feet altitude, that most of us reached the forest hut towards sunset. We had to cross an elephant trench in order to reach it, and the two rooms were just big enough to accommodate our camp beds. As we wanted to make this hut our headquarters, the first thing to do was to make a time table and to fix on a menu. We decided to go out at daybreak, to return between 1 and 4 p.m., after that to press plants till sunset. The menu caused us very little trouble. There was no quarrel about the choice and sequence of the courses:

Early morning: Café noir with native bread.

Lunch: Rice and pepper sauce with café noir.

Dinner: Rice and pepper sauce with café noir.

It happened once or twice that Mr. Prater shot a giant squirrel, and when he had removed and bottled everything that science claimed, we were allowed to make a meal of the rest.

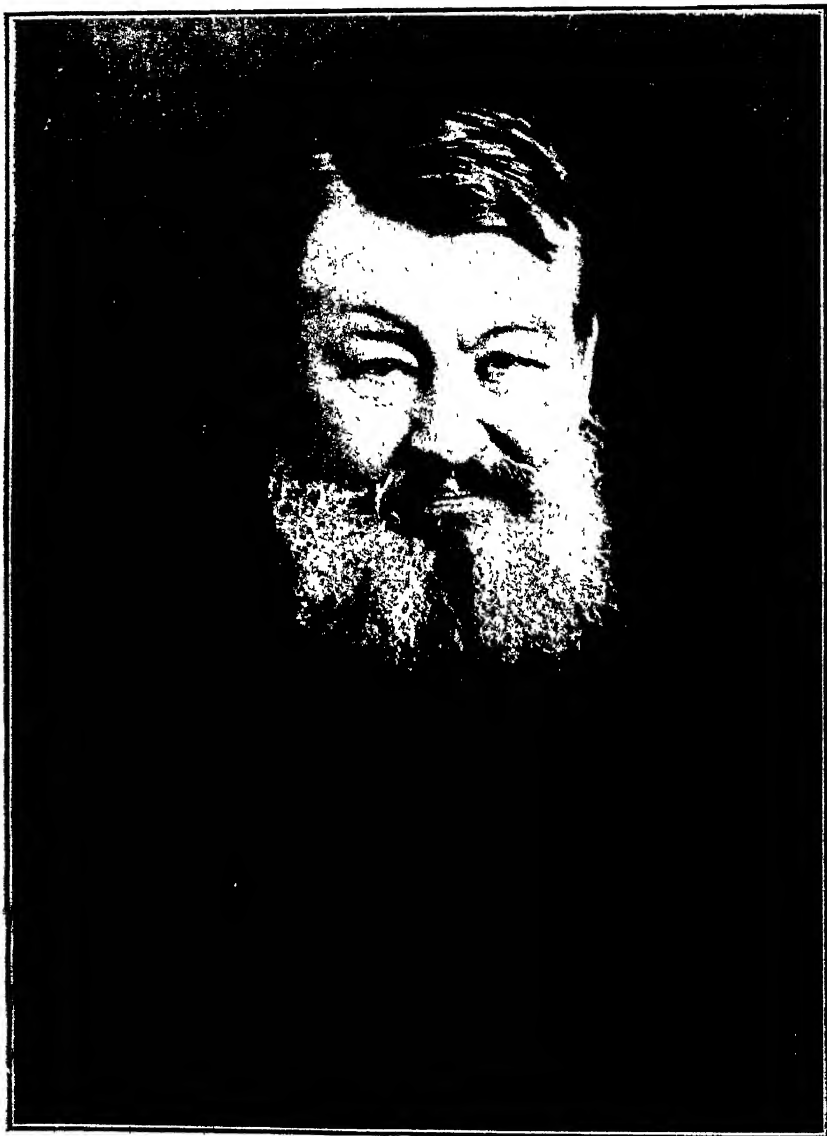
In spite of the meagre fare we have been able to make a complete botanical survey of the whole plateau, i.e., of a belt between 4,000 and 5,500 feet. The Survey map speaks of a dark impenetrable forest. This is literally true. You are free to examine the vegetation only along the solitary forest road, or on a path where an elephant has trodden before, or along a water course, if you like to walk for half a day in water up to your knees. A very few small bare patches exempted, the whole plateau forms one huge evergreen forest. The trees stand dense, have generally a rounded head, and rise to an enormous height. It is, therefore, very difficult to get at their flowers and fruits. In most cases it is impossible to climb the trees. Ropes and hooked knives on long sticks are useful under ordinary circumstances, but up there they could rarely be used. In many cases the gun was the only instrument to get leaves and flowers down. The stems are usually straight and so close together that huge trees, whose lower parts have decayed, are kept in position by their neighbours. The upper part of the stem and the branches are covered with epiphytic vegetation, usually ferns, orchids, species of *Piper*, and especially of *Kendrickia walkeri*, one of the most beautiful plants India has produced, not to mention a great profusion of the most varied mosses and lichens and parasitic species of *Loranthus* and *Viscum*. The undergrowth of the forest is dense and high, and perfectly impenetrable, unless you constantly use your hatchet. It is, however, no pleasure cutting down siliceous bamboos and spinous

Calami, when you have to disentangle yourself after every stroke. The elephants have done pioneer work in that direction. We are only sorry that we never met one of that tribe in order to express to him our deep-felt gratitude. We must, indeed, be grateful to them; but for them our harvest would have been a poor one. We are strongly in favour of a law protecting that most scientific of Indian animals.

There is scarcely any herbaceous vegetation under the trees. The evergreen forest can at once be distinguished from the deciduous one by the almost total absence of grasses. It was only on bare rocky spots or along the water courses that we found a varied herbaceous flora. Several species of *Impatiens* and *Begonia*, *Utricularia*, *Klugia notoniana*, *Viola*, *Thalettum Javanicum*, *Polygala*, *Drosera*, *Burmansia*, *Lobelia*, *Kalanchoe*, etc., were found in those localities.

The ferns deserve a special note, and I have to thank Mr. Almeida for it. A few hundred feet from the foot of the mountain we meet those ferns which are able to withstand the heat of the sun and long periods of drought. *Adiantum caudatum* first makes its appearance. Higher up the beautiful little *Actinopteris*, which is likewise an inhabitant of dry rocky places, attracts our attention, and from the crevices in the rocks project the heart-shaped fronds of *Hemionitis*. The hardy *Schizoloma ensifolia* and the bracken fern (*Pteris aquilina*) occur higher up at about 3,000 feet elevation. But the favourite habitat of the ferns is the evergreen forest, where shade, shelter, and abundance of moisture have given rise to their most luxuriant development. There in the twilight of the forest, the *Aspleniceæ* vie with each other in the delicacy of their foliage. Of the *Aspidiceæ* the most interesting plant is *Oleandra muscifolia* whose stem, resembling a serpent, hangs down from the rocky ledge. The most favourite spots, however, are the mossy banks of the brooks. It is here that we find the gigantic tree-ferns. One of these, *Cyathea spinulosa*, acquires in some places a height of 15-20 feet.

So far the general aspect of the vegetation. As to the exact composition of the flora we shall be able to give accurate data after having worked out the material. In the meantime it may suffice to indicate the chief distinctive characters of the flora of the High Wavy Mountain, when contrasted with the vegetation of the Deccan. It is firstly the presence of a great number of *Guttiferae*, *Dipterocarpaceæ*, *Myristicaceæ*, *Palmae*, and *Bambuseæ*, secondly, the great excess of species of Malayan type, especially *Sterculiaceæ*, *Anacardiaceæ*, *Meliaceæ*, *Ampelidaceæ*, *Gesneraceæ*, *Piperaceæ* and *Orchidaceæ*. We have examined only a small part of about 2,000 specimens brought home. The result seems to be satisfactory. Of Orchids we have described 6 new species and several varieties, of Vines about 5 species. Other orders, too, seem to promise well. It is not astonishing in the least that there should be many new species. If we consider that Fyson has discovered 13 new species on the Nilgiri and Palni Hills (above 6,500 feet) which had been explored repeatedly by many botanists in the course of 150 years, it is only natural that unknown forms should be found in a somewhat isolated area, which has never been visited, not even by a collector. There are many similar spots in India and of a much wider area, which are practically unknown from a botanical point of view.



THE LATE FR. DRECKMANN, S.J.

OBITUARY NOTICE.

It is our painful duty to record in this Journal the death of two of our members, *viz.*, the Rev. Father F. Dreckmann, S.J., and Lt.-Col. K. R. Kirtikar, I.M.S. (Retd.)

REV. FATHER F. DRECKMANN, S.J.

Fr. Dreckmann was born at Soest in Westphalia on the 11th August 1840 and joined the Society of Jesus at the age of nineteen. After going through the usual comprehensive course of philosophical, scientific and theological studies, he was sent to India. It is interesting to note that he was posted to this country by a mere accident. It was arranged that he was to go to Ecuador as Professor of Physics, and he had already begun to study Spanish when an inquiry came from his superiors if he would proceed to India. He willingly consented. Six weeks were all that was allowed to him to learn the language in England, and at the end of that period he sailed for India and arrived in Bombay on the 13th November 1874.

He was posted to St. Xavier's College. Being appointed to superintend the boarding establishment for a few months, he was soon made Professor of Physics. A former student of his writes of this period: "Being of a scientific turn of mind and having a natural predelection for scientific pursuits, Fr. Dreckmann had devoted considerable attention in his student days to the study of science and thoroughly mastered its principles. Mathematics and Physics were his speciality. Having a clear intellect and a powerful memory, though hampered by a weak husky voice, he soon succeeded in arresting attention and gained the confidence of his students. Talking of his memory, I am reminded of his habit of working out the most difficult problems in Trigonometry and Physics from memory alone, without touching the black-board, and inculcating the same habit upon us. Whether it was a problem in Heat or Sound, or a complicated example in the co-efficient of friction, the same method was followed, and when, at the end, the question was put to us, as was his wont, 'Is it clear?', and the whole class with one voice answered: 'No, Father, it is not!' it was a study to watch his face, simple, innocent, guileless, wondering for the nonce how a set of rational beings could really be incapable of understanding 'such a simple thing.'"

In 1884, Fr. Dreckmann was made Principal of St. Xavier's College. In 1882 already he had been elected a Fellow of the Bombay University and was a member of the Syndicate for over 20 years. That his work in the educational line was appreciated we may judge from a few remarks made by the Director of Public Instruction in his official report for 1902-07: "The Principal, Fr. Dreckmann, is one of the oldest members of the University, and one of its wisest and most trusted advisers."

But there were other spheres of his activity in which he was equally useful. He was a zealous and enthusiastic student of Natural History and a prominent member of our Society almost from its very beginning. He contributed some interesting notes to the earlier volumes of our Journal and the very first plate published by the Society belongs to an article on "An Undescribed Hamalopsida" from the pen of Fr. Dreckmann. He was a member of the Managing Committee, acted as one of the Vice-Presidents for a number of years, and was President of the Reptile and Fish Section.

From early youth he took a delight in watching reptiles and birds and later in life he made a special study of the snakes of the Bombay Presidency. During his holidays, which he always spent at Khandala, he would wander about in the wild romantic ravine that stretches out between the "Reversing Station" and the "Duke's Nose," and study its fauna and flora. Bloodsuckers, scorpions, spiders, jungle cats, snakes and other interesting denizens of the wilds of nature were the most favourite objects of his observations. He knew how to catch alive the most deadly snakes, with an almost uncanny calmness, and would watch their habits in captivity. A considerable part of the biological collections of St. Xavier's College consists of reptiles which he had caught and prepared himself. Fr. Dreckmann was not a writer and very little has been published under his name; but many a scientific article written by others, has been enriched by his valuable accurate observations.

In 1910, Fr. Dreckmann retired from the post of Principal which he had occupied for a full quarter of a century. He would have no farewell meeting or ceremonies of any kind. He disappeared from Bombay and took refuge in his favourite place, Khandala. But the loneliness of St. Xavier's Sanatorium, and the piercing winds that blew there from the Deccan during the cold season, were too much for him, and by the middle of February 1911 he returned to the College. There he spent some quiet years, till about 18 months before his death the sufferings of old age confined him to his room. This was a severe trial for one of so great natural energy and interest.

Fr. Dreckmann died on the 7th June of this year. We have lost in him a man of deep conviction, transparent sincerity, and unflinching courage in expressing his opinion. He would stand no nonsense, there was no humbugging with him, he hated cant and hypocrisy, he liked to deal with men who were sincere and upright and anything savouring of underhand dealing was detestable to him. All who have met him will remember his robust figure, his deep-set piercing blue eyes, his bluff manner, and at times his scowling looks, but they will, at the same time, never forget, that under the grim exterior there beat the kindest of hearts.

LIEUT.-COL. K. R. KIRTIKAR, I.M.S. (RETD.)

Lieut.-Col. Kirtikar was born in Bombay on 24th May 1849. After the usual College education he joined the Grant Medical College in 1871. Three years later he left for England to compete for the Indian Medical Service. He returned to India in 1877 and was placed on general duty in Bombay. When the Afghan war broke out he was on field service from 1878 to 1880. For his gallant behaviour at the battle of Maiwand, Surgeon Kirtikar was appointed Civil Surgeon of Thana in 1881. The following years saw him in a great variety of offices. He was Fellow of the Bombay University, Syndic in Medicine, Professor of Anatomy, Botany, and *Materia Medica* at the Grant Medical College, and held in addition a number of medical appointments. In 1902 he became Brigade Surgeon-Lieut.-Col. In 1904 he retired after completing the 55th year of his age and 27 years of useful and distinguished service.

The interests of Lieut.-Col. Kirtikar were many and varied, social, literary and scientific. There is specially one subject for which he has shown not only a keen interest but also a marked talent throughout his whole career, *viz.*, Botany. It was shortly after his retirement from public service that I paid him a visit at Andheri, which he had chosen as a residence for the rest of his life. I found him amidst his books, chiefly botanic, and he delighted in showing me his valuable volumes, his microscopes, his collections of dried plants, his water-colours of Algæ and Fungi, and many other things that interest only an enthusiast. All this was the result of his spare hours (for he had been a busy man); he had kept his eyes open, he had read a good deal, he had seen much in many lands, he had taken notes on many botanical subjects and jotted them down in books and on slips of paper that were scattered all over the library. There is no department in Botany, except perhaps physiology, which he did not cultivate. To him personally this way of studying must have been a source of constant pleasure, and we do not blame him for having followed his own likings. But if we consider, what a talent like his could have achieved in the advancement of botanical science in India, we can scarcely suppress a feeling of regret at the thought, that there was not more method and more concentration in his way of working. These remarks, however, must not close our eyes to the real value of the work he has done. The many contributions to our journal were written at a time when professional duties claimed all his energy, and it is astonishing that he has been able to do so much. A posthumous work of his on the "Medicinal Plants of India" will soon see the light, as he entrusted its publication to his friend Major B. D. Basu, I. M. S.

I need not describe his character. Those who had the pleasure of meeting him know only too well that by his death on 9th May a real gentleman and a faithful friend has passed from our midst.

E. B.

MISCELLANEOUS NOTES.

No. I.—THE BREEDING OF THE WHITE-EARED BULBUL
(*MOLPASTES LEUCOTIS*).

In the Fauna (Volume I, page 274) the breeding season of this species is given as "from May to August" and the number of eggs laid as "three or four."

In Hume's "Nests and Eggs" (page 177 of Volume I, 2nd Edition) it is noted that it breeds "for the most part in July and August in the Punjab, but somewhat earlier in Sindh. I have, even in Rajputana, seen eggs towards the end of May, but this is the exception."

It may therefore be worth noting that the breeding season in this district, where the bird is common, begins towards the end of March, and that frequently not more than 2 eggs are laid.

I give below particulars of nests found this year:—

March 26th.	A nest containing	3 eggs,	slightly incubated.
" 27th "	" "	1 egg,	nest deserted.
" 28th "	" "	2 eggs,	hard set.
" " "	" "	2 "	slightly incubated.
" " "	" "	3 "	on the point of hatching.
" " "	" "	2 "	incubation just begun.
" " "	" "	3 "	fresh.
" 31st "	" "	3 "	incubated.
" " "	" "	2 "	half-fledged young.

1 of these nests was in a small Jhand tree (*Prosopis spicigera*), 1 in a Kari bush (*Capparis aphylla*), 5 in Ber bushes (*Zizyphus jujuba*), and 2 in Sarkanda grass.

H. W. WAITE,
Indian Police.

FEROZPORE, PUNJAB, 1st April 1917.

[In the British Museum there are two clutches from Jask taken by Mr. S. Butcher on 23rd and 29th March respectively—EDS.]

No. II.—THE INDIAN GRACKLE OR "HILL MYNAH"
(*GRACULUS INTERMEDIUS*) RESIDENT IN CALCUTTA.

I send you the following information as it may interest some of your readers. Last month while spending a week end at the Botanical Gardens, Sibpur, I was walking round the Gardens with the Curator and on approaching some fine tall trees I was greeted by a familiar sound which I did not expect to find down here. On peering about I spotted a fair number of Hill Mynahs in among the topmost branches of the Casuarina and Mahogany trees. On pointing the birds out to my friend, he told me that Lady Prain some 14 years ago let 4 pairs of *Graculus intermedius* loose in the gardens and that ever since they had stayed and bred here. I think this fact of the Hill Mynah having gone back to his wild state and doing well in a climate like Calcutta is interesting.

A. E. LOWRIE, CAPT., I.A.S.O.

CONTINENTAL HOTEL, CALCUTTA,
12th June 1917.

[Though called the "Hill" Mynah this bird is not confined to the hills. It is found in the Himalayas, Assam and Burma to Malay Peninsula, and is the Mynah Terai, where it breeds and Ball recorded it from Gangpur, Jaipur, Bikaner, etc. A race is found in the Andamans.—EDS.]

No. III.—NOTE ON THE GREAT BROWN VULTURE
(*VULTUR MONACHUS*) IN CAPTIVITY.

Last May (1915) this young bird was brought in by a Wazir, who stated that he had taken it out of a nest in the Marwattai mountains, N. W. of the Wano Plain, after shooting the parent bird. He said that the nest was at the top of a large fir tree. The previous year when I was up in the Mar-wattais in about the same place as this nest is said to have been found, I saw a nest of a large vulture containing one young bird, and watched it from the top of a cliff with my glasses. I think it was very probably the same nest.

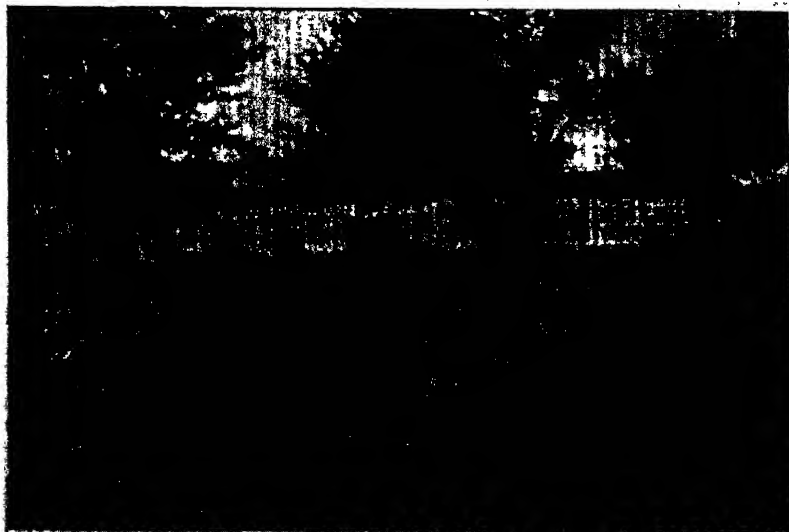
When this young bird was brought in to me it cannot have been more than a few days old, and it was then covered with brownish-grey down. The cere was light pink and bill darkish at tip, irides yellowish, legs and feet creamy white, and claws black. I fed it on raw meat and it grew very fast. Photo 1 shews it as it was at about a month old. It had





No. 2.

show any inclination to fly for a long time and when it did seem to wish to, it did not know how to. It would spread and flap its wings and jump up into the air, but never got any distance off the ground until it was about 5 months old, when it gradually took to taking short flights. It is now a



No. 3.

year old and can fly quite well, but it never leaves the Fort. It is quite tame but does not care about being handled, although it will submit to having the back of its head rubbed. The last photo shews the bird in its full plumage. It is now beginning to molt.

The description of the adult bird as given in Jerdon is correct, except that the cere of my bird is almost salmon-pink, and the naked part of the neck is dirty white with a very slight tinge of red. The legs are creamy-white and not dusky-yellow.

I have never seen another specimen of this vulture round Wano, though the Common Brown Vulture and Bearded Vulture are common. I have occasionally seen a pair of them on the banks of the Indus near Dera Ismail Khan, and also near Murtaza at the foot of the hills.

[The above was written by the late Major F. L. Hughes, 20th Brownlow's Punjabis (South Waziristan Militia) about May 1916.

The vulture eventually disappeared in February 1917, having been in Wano Fort for nearly 2 years. Major Hughes presumed that it flew away of its own accord.]

NO. IV.—OCCURRENCE OF THE ASHY WOOD-PIGEON (*ALSO COMUS PULCHRICOLLIS*) IN THE JALPAIGURI DISTRICT.

While spending a holiday in the Duars with my friend Mr. E. O. Shebbare of the Forest Service, he told me that he had procured this bird at Gorumara on 1st May 1909. I failed to get the bird there myself and so was very pleased when he sent me a skin of this bird a short time ago which had also been got at Gorumara by Mr. W. P. Field and sent to him for identification. Mr. Field has shot this bird before also at Gorumara during the cold weather, I understand, his second specimen being got in November or April I believe.

Gorumara is about 15 miles as the crow flies from the foot of the hills, the Bangalore being situated in the forest. The general level of the country where the bird is got is about 300 ft. above mean sea level and so is very much lower than any of the elevations given by Mr. Stuart Baker in his "Indian Pigeons and Doves." Mr. Baker writes "this Pigeon is found in Nepal, Sikkim, and Tibet at elevations between 7,000 and 10,000 feet, possibly descending a good deal lower than this in winter." The lowest elevation mentioned by him is 4,000 feet. It will be seen from those figures that this bird is got at a very low elevation in *summer* and it is probable as presumed by Mr. Stuart Baker. It would appear that it is not a permanent resident at any rate in that part of the Duars. Mr. Stuart Baker writes, I understand they are fairly common in the Duars. There is no mistake in the identification as I have seen the bird in the Duars. Through the kindness of Mr. Stuart Baker I send this interesting note.

CHAS. B.

not killed
part of his

find of a single egg on the Chenab on the 28th April 1870, the following note may be of interest:—

I found this species breeding on a sand-bank in the Beas, near the junction with the Sutlej, on the 16th April last. Other species nesting on the same bank were the Indian River Tern (*Sterna seena*), The Indian Skimmer (*Rhynchops albicollis*) and the small Indian Pratincole (*Glareola lactea*).

I counted 9 nests in all of *Sterna anglica*, but there may have been one or two more which were not noticed. They were all more or less grouped with those of *Sterna seena*, on the middle, and highest, portion of the bank, where there were occasional small tufts of grass. In each case the nest consisted of a slight depression in a tiny mound of sand, which in one or two instances appeared to have been scooped up by the birds. Every nest contained one or two small pieces of stick or other debris for the eggs to rest on, except that in one case a little dry grass had been provided instead. This fact alone would have served to distinguish the nests from those of *Sterna seena*, which were invariably bare depressions in the sand. One of the nest contained 1 egg only, while of the rest, three contained 3, and five 2. All the eggs which I took were perfectly fresh. I shot one bird, a male, to make certain of identification. The birds of this species did not appear to be on particularly good terms with their neighbours, and I noticed them "having words with" *Sterna seena* and *Rhynchops albicollis* on more than one occasion. The two latter species, however, never seemed to quarrel. Their nests were freely intermingled, although *Rhynchops albicollis* appeared to have a preference for absolutely bare sand without a trace of vegetation.

The nests of *Sterna seena* were by far the most numerous. None contained more than 3 eggs, and every egg which I took was perfectly fresh. The same was the case with *Rhynchops albicollis*.

Of all the denizens of the bank, *Sterna seena* resented my intrusion least, whilst *Glareola lactea* was the most perturbed. This was probably due to the fact that the eggs of the latter species were mostly in various stages of incubation. All their nests were grouped together on one side of the bank, not far from the water's edge. I found 3 eggs in one nest, but this was the only case in which there were more than two.

A solitary pair of Black-bellied Terns (*Sterna melanogaster*) were noticed flying over the bank, and their nest was afterwards discovered on the mainland, some 15 or 20 yards from the water's edge, lower down the river. It contained two slightly incubated eggs.

This was the only nest found of this species. There were a few nests of *Glareola lactea* in the vicinity, none of which contained more than one egg.

FEROZEPUR, PUNJAB,
3rd July 1917.

H. W. WAITE,
Indian Police.

NO. VI.—LATE STAY OF TEAL (*NETTUM CRECCA*).

On the evenings of the 27th and 30th April and 2nd May of this year about 6-30 P.M. I have seen three large flocks of teal flying north. Is this not very late in the year?

I was standing in the same place on each evening and on each occasion the flocks flew straight over my head.

I should be interested to hear whether it is usual for teal to stay so late. There were uncommonly scarce in these parts this year during the shooting season.

AGAR, MALWA, C. I.,
3rd May 1917.

E. J. D. COLVIN, Capt.

No. VII.—THE HEIGHT AT WHICH BIRDS ARE ABLE TO FLY.

On page 606, No. 3, Vol. XXIV of our Journal, Mr. Hankin asks for information on the above point, so the following may be of interest to him. A few years ago I was stalking a herd of Bhurrel (*Oris nahura*). The herd was browsing on the hill side about 1,000 feet above me and a sentry was on the look out, motionless, on a projecting ledge, so it behoved me to be particularly careful. I had been for sometime reclining against a rock, screened from those all seeing eyes by a juniper hedge, and biding my time until they should move on for their midday quarters. I had been amusing myself watching a flock of choughs circling over a peak straight above the sheep, with a powerful pair of Zeiss glasses (12 magnification), when into my vision there came, what I, at first, took for a white feather floating across the sky. This was followed by another and still another and interested me not a little. I then steadied my glasses against my knees, and my head against the boulder and looked more carefully. I then thought they must be white pigeons, but could not understand what pigeons could be doing at such heights. When they came directly over me, I was able to see that they were not pigeons, as I could just make out the slow deliberate beat of the wing of some very big bird. There were five altogether and they came from the direction of the plains and were passing over in a north-easterly direction.

I could see no marking of any sort on them and they all appeared to me to be pure white. The flight was that of a stork or crane.

A few slow deliberate flaps, and then a bout of sailing on still pinions, the former indulged in at very long intervals. The birds were obviously migrating though rather late in the year (end of May), and assuming they were storks or Siberian Cranes, i.e., birds about 10 feet or so from tip to tip, or what height they have been flying above me, to appear the size of

the above, or at absolutely clear morning, in such

the height at which birds have been seen

the height at which birds have been seen

the height at which birds have been seen

the height at which birds have been seen

In the case of most of the large birds of prey, if you take the span as between 3 and 4 times the length of the wing, you will not be far wrong. For instance:—

A. chrysaëtus—Wing say 25", span 80 to 88 inches.

A. heliaca—Wing say 24½", span 82" (a specimen carefully measured by me lately).

Gypaëtus barbatus—Wing say 32", span 9 to 9½ feet.

This being the case it is hardly conceivable that any bird with a 32" wing can possibly have a span of anything approaching 18 feet.

It is true that an Adjutant is a bigger bird than either of the above mentioned, and when seen soaring in company with Vultures, he certainly looks bigger, but I should not think that there is much more than a couple of feet, at most, between them. The Cinereous Vulture (*V. monachus*) and the Himalayan Griffon (*Gyps himalayensis*) with a wing measurement of 30" in each case would probably have a spread of 10 feet or so, as they appear, if anything, a trifle larger than the Lammergeyer on the wing, but as I have never measured them I cannot speak with any degree of certainty.

Differences in size in the same species are of course, possible, but the actual amount would not count for much, except in the case of a male and female in which case there might be as much as a foot between a large female and a small male, of the same species.

Any authenticated figures on the subject would be most interesting and I trust before long, some of our Members will oblige with their experiences.

DHARMSALA, 10th April 1917.

C. H. DONALD, F.Z.S.

NO. IX.—NOTES ON THE BIRD LIFE OF AHWAZ, PERSIA.

The following notes have been collected in the intervals of military duty whilst stationed at Ahwaz. I forward them for what they are worth:—

The Raven (*Corvus corax*).—Several pairs observed during January, February and March after which they disappeared, probably to breed.

The Grey-backed Warbler (*Aëdon familiaris*).—Breeds at the beginning of May. Constructs a rather obvious nest of sticks in a low bush, lining the nest with the small cottony capitulated heads of a composite plant. Eggs 4 in number almost identical in colouration with those of the King Crow of India. Spreads its brown chestnut tail at intervals like the Fan-tailed Flycatcher.

The Olivaceous Tree-Warbler (*Hypolais pallida*).—Fairly common.

Streaked Wren-Warbler (*Prinia lepida*).—Breeds in small tamarisk bushes along the banks of the Karun in May and June.

Lesser Grey Shrike (*Lanius minor*).—Shot a specimen in April 1917.

Pale-brown Shrike (*Lanius isabellinus*).—Shot a specimen in April 1917.

Caucasus Starling (*Sturnus vulgaris caucasicus*).—Abundant during winter.

The Wheatear Chat (*Saricola renanthe*).—Shot a specimen in April 1917.

House Sparrow (*Passer domesticus*).—Exceedingly common.

The Ortolan Bunting (*Emberiza hortulana*).—Shot a specimen in April 1917.

Swallow (*Hirundo rustica*).—Common. Breeds in April.

Sand Martin (*Cotile riparia*).—Fairly common.

Large Crested Lark (*Galerita cristata magna*).—Common. Breeds in May.

Egyptian Nightjar (*Caprimulgus egyptius*).—I found these birds in May but could not find their eggs.

Pale Brown Swift (*Cypselus murinus*).—Common. Probably breeds in May.

European Roller (*Coracias garrula*).—Common. Breeds in May. Seen on the banks of the Karun about middle of May.

Blue-cheeked Bee-eater (*Merops persicus*).—Arrives in March and breeds in May in the banks of the Karun and in trenches around Ahwaz.

European Bee-eater (*Merops apiaster*).—Breeds in May and June in similar situations to *M. persicus*.

Pied Kingfisher (*Ceryle rudis*).—Only a few pairs seen in the vicinity of Ahwaz.

White-breasted Kingfisher (*Halcyon smyrnensis*).—Rare around Ahwaz.

European Hoopoe (*Upupa epops*).—Fairly common during March and April.

Black Kite (*Milvus migrans*).—Common around Ahwaz in the winter and early spring. Disappears as soon as the hot weather sets in.

Pale Harrier (*Circus macrurus*).—Seen only in January, February and March.

Egyptian Vulture (*Neophron percnopterus*).—Common. Breeds in March and April.

Griffon Vulture (*Gyps fulvus*).—Common in spring of 1917.

Turtle Dove (*Turtur communis*).—Appears in the corn fields when the crops are ripe. Disappears with the advent of the hot weather.

Large pin-tailed Sand-grouse (*Pteroclorus alchata*).—Occurs around Ahwaz and throughout desert tracks on both banks of the Karun in almost inconceivable numbers. In the winter they keep for the most part in flocks of enormous size. I never struck a drinking pool. They pair in April and lay at the end of May and beginning of June. Clutches vary from 2-3, more often the latter. No attempt at any nest, just a mere depression in the ground serves their purpose. There seems to be a good deal of local migration. Towards the latter half of April I observed such an event at Ahwaz. For almost a week hundreds of thousands of these birds could be seen in the cool of the morning and evening flying almost due south. How this bird manages to breed over her eggs on the bare ground, sweet at this season of the year by violent sand storms, and in the appalling heat of these months is beyond comprehension. There is great variation in the size and shape of the eggs.

Spotted Sand Grouse (*Pteroclorus senegallus*).—Occurs around Ahwaz, but is comparatively rare compared with *P. alchata*. Breeds there but I never secured a clutch.

Black Partridge (*Francoelinus vulgaris*).—Occur wherever there is favourable jungle.

Partridge (*Ammodramus bonhami*).—Occasionally seen during the winter in the small hills near Ahwaz.

Common Quail (*Coturnix communis*).—Saw a few during the early spring.

Common Pheasant (*Phasianus communis*).—Occurs and has been shot around

Ahwaz. Major Watts reports this bird from the

country. Major Watts reports a flock of about 2000 of these birds and about one day's march would let to one hundred thousand.

Common Pheasant (*Phasianus communis*).—Occurs around Ahwaz.

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just below the Ahwaz rapids. Clutches varied from 2-3. Nest a mere hollow in the sand generally under the shade of the Camel Thorn bush (*Alhagi manorum*).

Red-wattled Lapwing (*Sarcogrammus indicus*).—Fairly common. Breeds in April and May.

Lapwing or Peewit (*Vanellus vulgaris*).—Found sparingly in the winter months. Disappears in March.

White-tailed Lapwing (*Chettusia leucura*).—Common after rain.

Caspian Sand-Plover (*Egialitis asiatica*).—Arrives in March and is found in flocks on the open plains. Disappears in April.

Kentish Plover (*Egialitis alexandrina*).—Very common. Breeds in April and May. Clutch normally three, sometimes two.

Black-winged Stilt (*Himantopus candidus*).—Common after rain.

Avocet (*Recurvirostris avocetta*).—Common in winter after rain.

Black-tailed Godwit (*Limosa belgica*).—Common after rain.

Spotted Redshank (*Totanus fuscus*).—Shot two near Ahwaz in March 1917.

Ruff (*Pavoncella pugnax*).—Shot a specimen at Ahwaz on 29th March 1917. Saw a few others.

Dunlin (*Tringa alpina*).—Shot a specimen on 18th March 1917.

Common Snipe (*Gallinago caelestis*).—Common.

Woodcock (*Scolopax rusticola*).—Recorded from Shush by Major Watts.

Laughing Gull (*Larus ridibundus*).—Common around Ahwaz in the spring.

White-winged Black Tern (*Hydrocheledon leucoptera*).—Saw a pair flying up the Karun, 18th May 1917.

Common Tern (*Sterna fluviatilis*).—Saw 2 or 3 pairs around Ahwaz in May, where it probably breeds.

Little Tern (*Sterna minuta*) Black-shafted Ternlet (*Sterna saundersi*).—Either one or the other, or possibly both of these species are found sparingly on the Karun around Ahwaz, where they breed on the islands. I did not shoot any specimens.

Common Cormorant (*Phalacrocorax carbo*).—Saw a few small flocks of these birds in the winter.

White Stork (*Ciconia alba*).—Common at Ahwaz in February and March after rain.

Common Heron (*Ardea cinerea*).—Found sparingly on the Karun near Ahwaz in winter and spring.

Bittern (*Botaurus stellaris*).—Shot a single specimen at Ahwaz in February 1917.

Grey Lag Goose (*Anser ferus*).—Found occasionally around Ahwaz in the winter.

Sheldrake (*Tadorna cornuta*).—Saw a pair at Ahwaz in February 1917.

Mallard (*Anas boschas*).—Common.

Gadwall (*Chauelasmus streperus*).—Shot a ♂ in February 1917. Common at Shush.

Common Teal (*Nettion crecca*).—Common.

Pintail (*Dafila acuta*).—Common.

Shoveller (*Spatula clypeata*).—Common.

Marbled Duck (*Marmaronetta angustirostris*).—Major Watts records this bird as breeding at Shush in May 1916. This is interesting. I have already secured eggs of this species at Sonmeani on the Baluchistan coast. Mr. Atken also records it breeding on the Khushdil Khan Lake, Quetta.

It is almost certain also that it breeds sparingly in Sind. I quote the following from my note-book, 28th December 1915:—

"Have just returned from the Manchar Lake, Sind. The birds are scarce but the Marbled Duck breeds on the lake in small numbers."

favourable years. I have no reason for doubting this information as it was volunteered, and moreover these Mohannas know the Sindhi and English names of every duck to be found there. It seems to me that the Marbled Duck must now be regarded as a regular breeder in Sind and Baluchistan.

Pochard or Dun-bird (*Nyroca ferina*).—Shot a ♂ in February 1917.

MESOPOTAMIA EXPEDITIONARY FORCE,
May 1917.

F. LUDLOW, I.A.R.O.

NO. X.—THE WEIGHTS OF PINTAIL AND FANTAIL SNIPE.

Since writing to you on 18th January 1915 on the subject of the comparative weights of Pintail and Fantail Snipe, I have now compiled the figures for the past three seasons in this neighbourhood, and submit them, as I think they may be of some interest. I shall be glad to hear if others have carried out similar experiments, and to compare their results with mine.

SEASON: September 1914—March 1915.

The average weight of 375 Pintails was 3.90 oz. while that of 151 Fantails was 3.25 oz.

SEASON: October 1915—April 1916.

The average weight of 998 Pintails was 3.81 oz. while that of 84 Fantail was 3.51 oz.

SEASON: September 1916—March 1917.

The average weight of 974 Pintails was 4.07 oz. while that of 63 Fantails was 3.48 oz.

Very occasionally a big Fantail would be found, and I have a note of one weighing 5½ oz., shot on 20th February 1916 and one of 5 oz. shot on 11th March 1917.

The above appears to be conclusive that in Southern India at any rate the Pintail is definitely the lighter bird.

I have also taken account of the fact that not a single specimen of the Fantail was taken by my hunter of myself, except a single one taken by him on the 10th September. My hunter is a very experienced and expert shot, and I am sure that he has not taken a single Fantail since I got him to his bag.

MADRAS S. INDIA, 1917. R. F. STONEY.

NO. XI.—THE BRONZE-BACKED TREE SNAKE (*DENDROLAPHIS TRISTIS*) IN CENTRAL INDIA.

Is the *Dendrolaphis tristis*? If so, Wall says: "It has not been recorded from Central India." It is very common in the tank forests here and was called by the natives the "tying snake." It is a very common snake in the tank forests here and was called by the natives the "tying snake." It is a very common snake in the tank forests here and was called by the natives the "tying snake."

O. H. STONEY.

It is a very common snake in the tank forests here and was called by the natives the "tying snake."

NO. XII.—THE BRONZE-BACKED TREE SNAKE (*DENDROLAPHIS TRISTIS*) IN CENTRAL INDIA.

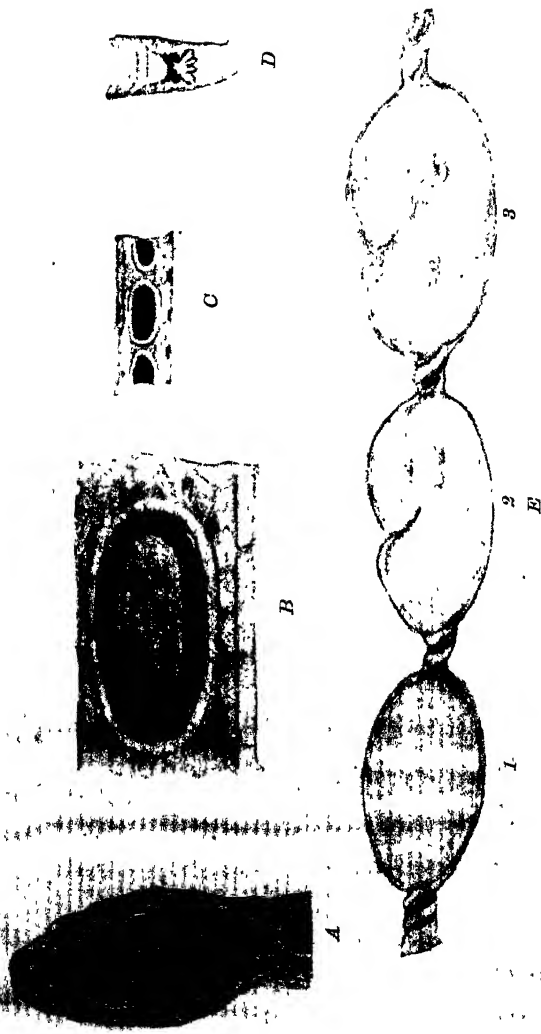
It is a very common snake in the tank forests here and was called by the natives the "tying snake."

O. H. STONEY.

It is a very common snake in the tank forests here and was called by the natives the "tying snake."

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THE RUSSELL'S VIPER (*VIPERA RUSSELLI*).

EXPLANATION OF FIGURES.

- A. The characteristic markings on the head of a newly born viper.
- B. The dark ring edged with white, surrounding an oval chocolate brown area (adult).
- C. The undifferentiated oval spot edged with white (new-born viper).
- D. Sacs or coeca near the vent.
- E. Three eggs connected by a strand formed by egg-membrane : 1 The most anterior least developed ; 2 and 3 more advanced.

India is thus bridged over by these records, and it now remains to find out how far it extends northward into the United Provinces. There were no specimens of it in the Lucknow Museum, when I examined the snakes there in December 1908.

My specimen, which is deposited in the Nagpur Museum, is a typical one, except that the scale rows reduce to 13 at about 3 inches before the middle of the body. The ventrals are 193 and the sub-caudals in 126 pairs.

E. A. D'ABREU, F.Z.S.

CENTRAL MUSEUM, NAGPUR, C. P.,
8th June 1917.

No. XIII.—NOTES ON THE RUSSELL'S VIPER.

(With a Plate.)

The following notes relate to the young ones which a Russell's viper produced in the Central College Museum. An adult female specimen, measuring about 4 feet, was obtained locally towards the first week of December 1916, and on the 8th June 1917, the young ones were born. Assuming that fertilisation took place in November,—there is no other evidence for this assumption than the testimony of the snake charmers who are unreliable in such matters—the period of gestation has occupied in this case roughly seven months.¹ Of the six young *daboia* that were produced, three were still-born, and in addition three eggs were deposited. Except in one egg, no trace of development could be made out in others and it is doubtful whether these latter were impregnated at all.² The eggs are translucent, reddish and are soft; the leathery shell of the eggs belonging to the *Elapinae* group is replaced by a soft membrane. They are held together by a gelatinous twisted cord which may be of immense length sometimes and which hardens on exposure. Each egg measures 30 mm. along the longer axis.

The young ones moult soon after rupturing the vitelline membrane. The following are the measurements of the largest specimen:—

Total length	.. .. .	225 mm.
Round the thickest part	.. .. .	38 mm.
Tail	.. .. .	30 mm.
Fang along the outer curve	.. .. .	5 mm.

The parent exhibits little concern about her offspring and interference with them extorted from her nothing more savage than a prolonged hiss. In the newly-born male specimens, the copulatory sacs are external and are four coecal outgrowths.³ The colouration of the young ones differ from the adults in certain particulars and the more interesting of them refer to a large diamond-shaped mark on the head, edged with white. A conspicuous white cross on the head behind this blotch is another interesting feature. It may be noticed that in the adults, the former practically disappears and the latter broadens out into a chocolate brown patch on the occiput. The dark rings (thrown into relief by a white outer border) in the adult enclose oval brown areas, but in the newly-born specimens, the rings are solid, black, oval or circular patches edged with white or may

¹ Fitz Simons gives the same period in the case of the puff adders of S. Africa. (Vide p. 223, South Afr. Snakes). Major F. Wall gives the same period. (Journ. Bombay Nat. Hist. Soc., Vol. XVIII.)

² The occurrence of unfertilised eggs anterior in position to those in advanced state of development in the enlarged oviducts (Uteri) is not uncommon in the *Daboia*. Such a condition was noticed when a gravid female was dissected some time ago.

³ Specimens illustrative of all these facts have been sent to the Director, Zoological Survey of India, Calcutta.

each side of the mouth and the Arab calls it *Gatan*. I hope you will get the skin safely.

MESOPOTAMIA, 16th April 1917.

W. A. LIGHT, MAJOR,
114th Mahrattas.

[The fish is *Barbus seich*.—EDS.]

NO. XVII.—THE PACKING OF PAPERED BUTTERFLIES FOR SAFEKEEPING OR DESPATCH BY POST.

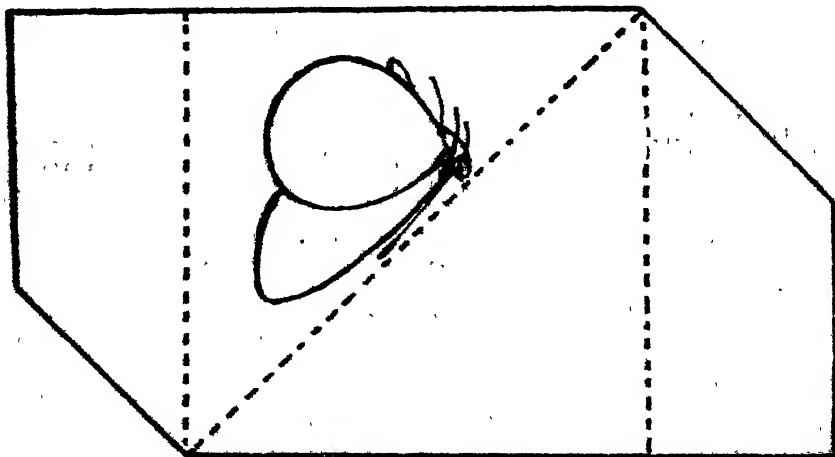
As set butterflies easily become damaged during transport from one place to another, some collectors in India keep their specimens in papers until able to set them in England.

Many collectors seem to take remarkably little trouble to preserve their papered specimens from damage; and as a little care in packing would mean all the difference between pleasure and disappointment on receiving specimens, a fellow-collector has persuaded me to send this note in case my method of packing specimens, which I have employed for some eight years past, may be of use to others.

A. Papering specimens.

Standard sizes of paper-triangles should be used. For small and medium sized butterflies semi-transparent butter-paper is best, as it enables the contents to be seen through the paper at a glance, and guards against spread of any grease that may form. For large triangles use stronger glazed paper such as that of English illustrated weeklies, as glazed paper does not rub the scales off the wings.

Place the newly captured butterfly with the antennæ close against the forewings and at the fold of the paper, so that they dry in that position

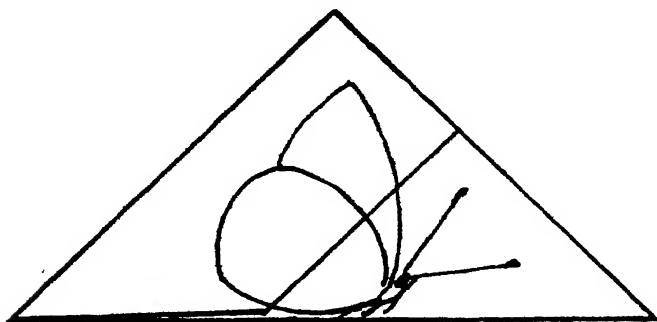


3. Paper for Medium Paper Triangle.

Fold at dotted lines.

Butterfly placed with antennæ against

safe from injury (see sketch 3). Do not place it with body against the fold (see sketch 4) as in this position the antennæ almost always dry sticking out and eventually get broken off in handling the paper or specimen.



4. Paper triangle closed.
Butterfly unsafely placed.

If papered butterflies be massed together in a box any particular specimen cannot be got at without many being handled, resulting in damage to some sooner or later.

B. Making Packets for papered specimens.

The paper triangles should be kept in packets of corresponding standard sizes, so that these packets, fitting closely in an ordinary biscuit-tin, economise space and enable any one packet to be easily taken out without disturbing its contents.

The paper triangles should be so placed in a packet that the bodies of the specimens are alternately to left and right and so lie evenly; if not so placed they form a lopsided pile, and space is wasted and pressure is all on one side.

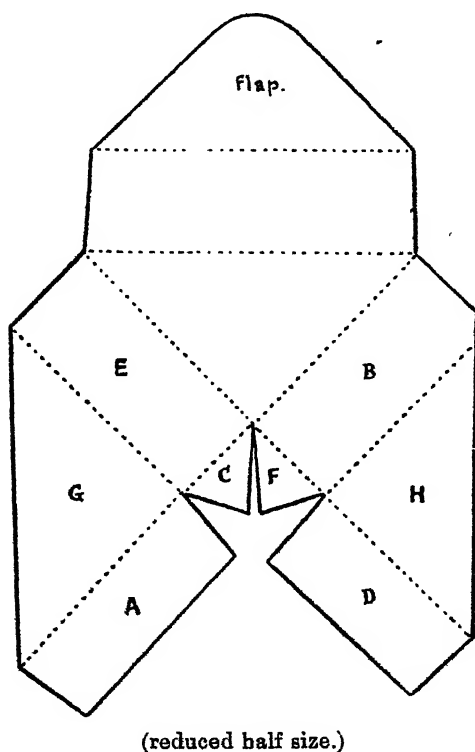
All packets should be of uniform height,—1 inch—so forming 2 or 3 tiers in the tin according to the kind of biscuit-tin used; and each packet should contain just so many specimens as not to be loose in it, and then the vertical sides of the packets take any weight or pressure.

A medium sized packet has its longest side about $3\frac{1}{2}$ inches; larger packets can be made double, or smaller ones half the size of this one. Stout paper such as Parchment-note answers best.

Attached is an outline pattern (reduced half size) for making such a packet (Fig. 1). Out along the outside continuous lines, and fold backwards at the dotted lines. This pattern may be used for outlining others with a pencil, keeping the centre portion of the pattern fixed with the fingers of the left hand, and turning up each portion after outlining as one works inwards. Paste A to underside of B so that C is between the two; then paste underside of D on to E with F between them. To close the packet inset the flap between G and H. A number of these outlined and cut out for packets, but not folded, can be kept ready to be made up into packets as they are wanted.

The pattern for packets should be of tough paper so that it will last a long time, and if some coloured paper be used for it the pattern will not get pasted together for a packet in mistake for one outlined from it.

The lower sketch (Fig. 2) shows an open completed packet.



1.

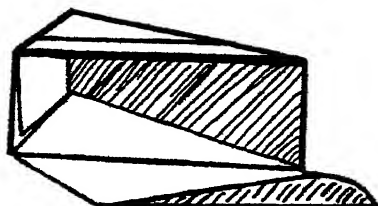
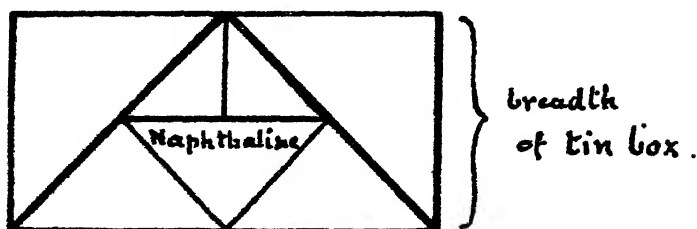


Diagram 5 shows an arrangement of three sizes of packets, say in the uppermost tier in a small biscuit-tin, a space in the middle being conveniently left for naphthaline.

Each packet is numbered and a list of contents pasted on the outside of the tin. Finally the tin is closed against damp and insects by a strip of 1 inch adhesive plaster all round the edge of the closed cover.



5. Arrangement of Packets in Tin box.

C. For despatch by post.

Tin boxes must be enclosed in a wooden one or they will be crushed. For sending 50 specimens or less small boxes made from cigar-box wood, taking a few packets only, and with a diagonal partition inside to prevent the top or bottom being crushed in, are useful.

Put postage-stamps on a tie-on label, *not* on the box.

BANNU, N.W.F.P.,
1st March 1917.

H. D. PEILE.

No. XVIII.—NOTE ON THE COLOUR OF FLOWERS IN *DYSOPHYLLA STELLATA*, BTH.

This species of *Dysophylla* is very common in South India and has purple flowers and staminal hairs in nature. The plant is apparently very variable in appearance so much so that Cooke in his *Flora of Bombay* includes the species *D. gracilis* and *D. tomentosa* of the *Flora of British India* as mere varieties of *D. stellata*. Recently specimens collected by me at Talaguppa in the extreme Western Ghats of Mysore showed a few plants of *D. stellata* with absolutely white flowers and white staminal hairs. In one of Wight's sheets in the Madras Herbarium (now at Coimbatore) the corolla is white and the stamens pink. This variation in colour of flowers has also been noted by Mr. Rangachari in *Asystasia coromandeliana* (yellow and white flowers) in *Striga lutea* (white, yellow, pink and brown corollas) and by Mr. Tadulingam in *Evolvulus alsinoides* (blue and white flowers). While the colour variation in the above plants is a common feature, the white flowered type in *Dysophylla* has been very rare. The few specimens collected by me were in a mass of the pink flowered specimens and no intermediates were observed by me. There is another minor difference in the colour of the stem near the inflorescence between the two types, the white flowered type being comparatively white or slightly pink. I therefore propose the name *Dysophylla stellata*, var. *alba* for the new plant.

M. K. VENKATA RAO,
Senior Assistant Mycologist,

BANGALORE, 6th March 1917.

No. XIX.—AN INTERESTING CASE OF DISTRIBUTION.

The genus *Pogonia* of the Orchidæ has two species growing in the Bombay Presidency, *P. carinata*, Lindl., and *P. plicata*, Lindl. In June last, I found an orchid near Koppa, Kadur District (Western Ghats of Mysore), which when sent to Coimbatore was identified as *Pogonia prainiana*, King and Prantling. This orchid has not hitherto been described in Mysore or the Bombay Presidency. Its occurrence in Mysore and its absence in the neighbouring country is a remarkable instance of distribution.

M. K. VENKATA RAO,
Senior Assistant Mycologist.

BANGALORE, 6th March 1917.

No. XX.—FALL OF SEED IN RAIN STORM.

On the night of April 12th last there was a heavy rain storm over a wide-spread area of the Junagadh State registering from 20 to 75 cents in the various villages. Over the whole area the rain was accompanied by a fall of seed locally known as Lal Jowari (or red jowari). I enclose a specimen of the seed collected.

The phenomenon is recognised by the villagers and in their opinion presages a fine season and generally good luck.

This seed does not occur in Kathiawar and must have been blown in from some neighbouring province. I am informed by the oldest Jain priest here that such falls occur at intervals of five or seven years and are invariably followed by a bumper season. Perhaps some of our members may have noticed similar occurrences in other parts of the country?

E. BROOK-FOX.

JUNAGADH, KATHIAWAR,
17th April 1917.

[The seed sent is a variety of *Sorghum vulgare*. Pers.—EDS.]

PROCEEDINGS

OF THE MEETING HELD ON 1st MARCH 1917.

A Meeting of members and their friends of the Bombay Natural History Society took place on Thursday, 1st March 1917, the Hon'ble Mr. Justice N. C. Macleod presiding.

The election of the following 13 members since the last meeting was announced:—Mr. G. G. Fletcher, Bombay; Mr. Fred. Hallberg, Bombay; Mr. E. G. Barter, I.C.S., Salem; Capt. E. J. Cumming, Ahmednagar; Mr. S. A. C. Green, I.C.S., Shahbandar; Mr. J. M. Conder, I.C.S., Kawkareik; Capt. W. B. M. Newland, I.M.S., Mesopotamia; Mrs. C. Fowler, Bombay; Major J. Husband, I.M.S., Bombay; The Honorary Secretary, Vellore Club, Vellore; Miss M. R. N. Holmer, M.A., Delhi; Capt. C. M. Thornhill, Mesopotamia. and Major Robert E. Wright, I.M.S., Bombay.

ELECTION OF THE COMMITTEE.

The following gentlemen were elected as office-bearers for the present year:—*President*.—H. E. The Right Hon'ble Lord Willingdon, G.O.I.E.; *Vice-Presidents*.—Mr. J. D. Inverarity, the Hon'ble Mr. Justice N. C. Macleod and H. H. The Rao Saheb of Cutch, G.O.I.E. *Managing Committee*.—Mr. T. Bainbrigge Fletcher, F.E.S.; Mr. T. R. Bell, I.F.S.; Mr. C. L. Burns; Rev. E. Blatter, S.J.; Mr. E. Comber, F.Z.S.; Lt.-Col. G. H. Evans, C.I.E.; Major M. L. Ferrar; Capt. F. C. Fraser, I.M.S.; Prof. G. A. Gammie, Mr. F. Hannington, I.C.S.; Mr. G. S. Hardy, I.C.S.; Prof. V. N. Hâte; Mr. N. B. Kinnear; Lt.-Col. K. R. Kirtikar, I.M.S. (Retd.); Major W. Glen Liston, C.I.E., I.M.S.; Mr. F. M. Mackwood; Mr. L. H. Savile; Mr. R. A. Spence; Lt.-Col. F. Wall, C.M.G., I.M.S., C.M.Z.S.; Mr. John Wallace, C.E. *Honorary Secretary*.—Mr. W. S. Millard. *Honorary Treasurer*.—Mr. L. Robertson, C.S.I., I.C.S.

CONTRIBUTIONS.

Contribution.	Locality.	Donor.
1 Persian Mongoose, <i>Mungos persicus</i> .	Mesopotamia	Lt.-Col. F. Wall, I.M.S., C.M.G.
1 Syrian Hedgehog, <i>Erinaceus calligoni</i> .		
2 Babylon Sheath-tailed bats, <i>Myotis blythii</i> .		
1 Mouse, <i>Mus</i> sp.		
3 Shrews, <i>Crocidura</i> sp.		
1 Caspian terapin, <i>Clemmys caspica</i> .		
11 Snakes		
3 Lizards		
1 Toad		
1 Scorpion		
1 Cockroach		
4 Tibetan Hare, <i>Lepus tibetanus</i> .	Wano, Waziristan	Capt. W. B. Cotton.
1 Jungle Cat, <i>Felis chaus</i> (alive)	Mesopotamia	Col. Sir P. Z. Cox.
11 Birds		

Contribution.	Locality.	Donor.
1 Jackal, <i>Canis aureus</i> }	Kut, Mesopotamia	Capt. C.R.S. Pitman.
4 Hares, <i>Lepus</i> sp. }		
11 Birds }		
1 Syrian Hedgehog, <i>Erinaceus calligoni</i> .	Mesopotamia ..	Mr. J. M. S. Culbertson.
1 Little Grebe, <i>Podiceps albipennis</i> .	Do. ..	Capt. R. Bagnall.
1 Smew, <i>Mergus albellus</i> ..		
1 White-fronted Goose, <i>Anser albifrons</i> .		
1 Tatera sp. }	Do. ..	Lieut. Brewster.
1 Jungle Cat, <i>Felis chaus</i> ..		
1 Large Spotted Eagle, <i>Aquila maculata</i> .		
1 Panther, <i>Felis pardus</i> ..	Legait, Mesopotamia.	Lieut. T. R. Livesey.
3 Foxes, <i>Vulpes</i> sp. }		
3 Mungoses, <i>Mungos mungo</i> ..		
2 Porcupines, <i>Hystrix</i> sp. ..	Mekran ..	Capt. J.E.B. Hotson.
1 Persian Hare, <i>Lepus craspedotis</i> .		
1 Gazelle }		
1 Palm Squirrel, <i>Funambulus pennanti argentescens</i> .	Nowshera ..	Major W. H. Lane.
8 Snakes }		
48 Birds }		
1 Indian Jungle Cat, <i>Felis affinis</i> ..	Thana, Bombay ..	Major M. L. Ferrar.
1 Wood-Snipe, <i>Gallinago nemoricola</i>	Larkana, Sind ..	Mr. G. A. Shillidy.
1 Sheldrake, <i>Tadorna cornuta</i> ..	Muscat ..	Major L. Haworth.
1 Grey's Snake, <i>Zamenis ventrimaculatus</i> .	Narsinghpur ..	Mr. P. S. Patuck, I.C.S.
2 Wild Dogs, <i>Cuon dukhunensis</i> juv (alive).		
1 Painted Stork, <i>Pseudotantalus leucocephalus</i> .	Delhi ..	Mr. W. E. Ashton James.
1 Bar-headed Goose, <i>Anser indicus</i> .	Nowshera ..	Major C. W. Prescott.
3 Yellow-legged Herring-gull, <i>Larus cachinans</i> .	Bombay ..	Mr. S. H. Prater.
2 Dark-backed Herring-gull, <i>Larus affinis</i> .		
2 Brown-headed Gull, <i>Larus bruneicephalus</i> .		

COLLECTION OF PLANTS.

With reference to the collection of plants which Capt. Hotson had for about a year, been sending to the Society from Persian Baluchistan, the Revd. E. Blatter made some interesting observations. In the course of his remarks he said:—His collections are of great interest to the student of ecology as well as of plant geography. Persian Baluchistan is virgin soil

for the botanist, as no collections have ever been brought home from that region. There have been travellers passing through that country, yet botanical science has not profited by them. We know a good deal about the flora of British Baluchistan (*i.e.*, British Baluchistan proper, the Agency Territories, and the Native States of Kalat and Las Bella). William Griffith Superintendent of the Hon. East Indian Company's garden at Calcutta, was the first to collect in Baluchistan. In November 1839, he joined the Army of the Indus in a scientific capacity, and penetrated, after the subjugation of Kabul, beyond the Hindu Kush into Khorasan, whence, as well as from Afghanistan and Baluchistan, he brought collections of great value and extent. In 1843 a book appeared entitled "Narrative of a Journey to Kalat," written by Masson, a surgeon. It contains numerous botanical references but on the whole it is more the book of an adventurer than of a botanist. The second botanist who visited Baluchistan was Dr. J. E. Stocks. In 1848, he crossed the Hab River and reached Shah Bhilawal. In 1850, he made another and longer trip into the country *via* Shikarpur and the Gundava Pass to Kalat, Quetta and Nushki. Between 1877 and 1880 extensive collections were made by Doctors O. T. Duke and Hamilton. Their plants were preserved at the Royal Botanic Garden, Calcutta. A few years later (1884-1885) we find Dr. J. E. Aitchison attached to the Afghan Delimitation Commission. He collected between Quetta and the Helmand river along the northern border of Baluchistan, and his results are embodied in the "Botany of the Afghan Delimitation Commission," which was published in the Transactions of the Linnean Society. Of more recent botanists who increased our knowledge of the Baluchistan flora we must mention J. H. Lace who was stationed in that country from 1884 to 1888 as Deputy Conservator of Forests, besides, J. S. Duthie, at the time Director of the Botanical Department of Northern India. He collected chiefly near Quetta on a visit to Baluchistan in 1888; and finally Lieut.-Colonel F. P. Maynard who, in 1896, accompanied the Baluch-Afghan Boundary Commission as medical officer. The results were published by I. H. Burkill and D. Prain in the records of the Botanical Survey of India (1897). Whatever in the way of publications, or specimens had been contributed towards the botanical exploration of Baluchistan during a period of 70 years, was collected and examined by I. H. Burkill and published in his "Working List of the Flowering Plants of Baluchistan" (1909). His final conclusion is that "the flora of Baluchistan is Persian in character, and very much less northern than that of Afghanistan; but it is northern enough to contain a violet, a primula, the English hawthorn, an anemone, a gentian, a juniper and plants of many genera familiar in north-western Europe."

So far we possess a fair knowledge of the country lying east of Persian Baluchistan. Much less is known of the parts adjoining it on the west, namely, of Persia proper. In the Northern Provinces of Gilan, Mazandaran, and Astarabad on the Caspian, from the shore to an altitude of about 3,000 ft. on the northern slopes of the great mountain range which separates those provinces from the high lands of Persia, the flora is similar to that of the Mediterranean region. At higher altitudes many forms of a more northern flora appear. As we approach inner Persia, the flora rapidly makes place to steppe vegetation in the plains, while the Mediterranean flora predominates in the hills. The steppe vegetation extends in the south to the outer range of the hills which separate inner Persia from the Persian Gulf and the Indian Ocean. Beyond this outer range and along the shore of the sea, the flora is that of the Sahara region which extends eastwards to Sind.

I need not point out that the conclusion arrived at by Burkill applies to the flora of Baluchistan as a whole, and it is easy to see what the verdict

will be if we distinguish, *v. g.*, a northern and southern sub-region and compare their respective floras with each other. The northern part will be more Afghan, whilst the southern part, (Brit. Makran), will show a greater resemblance to the Sind flora of the Indus region. The question, therefore, remains, whether Persian Baluchistan should be considered as part of the connective link between the desert region of N. Africa and Arabia on the one hand and Sind on the other? Captain Hotson's collections, together with what we know of the physical geography of the country, enable us to form a distinct idea of the plant, geographical position of the vegetation of Persian Baluchistan. The composition of the flora and its morphological and anatomical characters point to the conclusion that it belongs to the North-African-Indian desert, containing at the same time in the regions of higher altitude a number of types characteristic of the Mediterranean flora.

REPORT OF THE HONORARY TREASURER ON THE ACCOUNTS FOR 1916.

Mr. L. Robertson, C.S.I., I.C.S., the Honorary Treasurer said:—

I have much pleasure in presenting the Accounts for 1916.

At the end of 1915, we had balance in hand of Rs. 5,686, inclusive of Rs. 5,000 in Fixed Deposit.

The year closes with a balance of Rs. 5,702 inclusive of a Fixed Deposit of the same figure as above, Rs. 5,000.

In addition to the above working balance, the Society owns certain investments. These amounted at the beginning of the year to Rs. 43,000, at the end of this year this sum amounted to Rs. 47,800, an advance of Rs. 4,800. Our investments included a sum of Rs. 14,000 in $3\frac{1}{2}$ per cent. Government paper. When the Conversion Loan was issued last year, Mr. Millard and I had several consultations and we decided that it was in the interests of the Society to convert as much of our $3\frac{1}{2}$ per cent. paper as our resources would admit. Accordingly we bought Rs. 5,000 worth of the New Loan and were able to convert Rs. 5,200 of our $3\frac{1}{2}$ per cent. paper into 4 per cent. paper. Thus the invested balance now includes only Rs. 8,800 of $3\frac{1}{2}$ per cent. paper, while we now hold Rs. 10,000 New 4 per cent. Loan. This operation has, I think, added materially to the resources of the Society. The remainder of our invested balance consists of Rs. 14,000 of 4 per cent. Bombay Port Trust Unguaranteed Bonds and Rs. 15,000 City of Bombay Improvement Trust Bonds. I have stated all these figures at the face value of the paper. Of course the market value is at the present time much depreciated. There appears, however, to be no reasonable probability that we shall have to sell the Securities which now bring in an income of Rs. 1,868 a year.

I have said that there is no reasonable probability of our having to sell these Securities for this reason.

The financial prospects of such a Society as ours, depends almost entirely on the number of members. Last year I remarked that it was necessary to increase the number of members. I find from the Accounts that the income from subscriptions, entrance fees and Life Membership fees was Rs. 21,895 against Rs. 21,163 last year, which is a slight advance.

I see that our Secretary has collected many arrear subscriptions inclusive of one outstanding since 1912. On the other hand one generous gentleman has already paid $\frac{1}{2}$ of his subscription for 1918.

We have received our annual grant of Rs. 5,000 from the Government of Bombay on which, I think, in these days of War parsimony we may congratulate ourselves.

Turning to the Mammal Fund Accounts I find that we have increased our balance from Rs. 8,526 to Rs. 9,833. Of course we have not appealed for subscriptions; but we have actually received Rs. 2,483 in donations. Only one Collector, Mr. Baptista, has been working. All our English Collectors have joined the Army. Mr. Baptista has recently gone to work under Capt. Hotson who, as you know, joined the Indian Army. When the War is over and we can get our English collectors back again, it will be necessary to make an energetic appeal for funds.

I think the members will agree that in the circumstances the funds of the Society have been satisfactorily administered.

PROCEEDINGS OF THE MEETING HELD ON 1st MAY 1917.

An "At Home" of members and their friends of the Bombay Natural History Society took place on Tuesday, the 1st May.

The election of the following 11 new members since the last meeting was announced:—Lt. C. H. Delmege, R.E., Bangalore; Mr. Trimbak Govind Yeolekar, Poona; Mr. Ralph Randles Stewart, Rawalpindi; Lt.-Col. H. M. Halliday, Summerpur, Rajputana; Mr. William Whyte, Rangoon; Rev. F. C. B. Jourdain, Europe; Major C. W. Prescott, I.A., Nowshera; C. H. Hutton, Esq., Srinagar; Rev. W. M. Zumbro, Madura; Mrs. M. C. Arundel-Barker, Garhwal, and Mr. F. G. Butler, I.C.S.

CONTRIBUTIONS.

The Society is once again indebted to its members serving with the forces for a large part of its contributions since the last meeting. From Capt. J. E. B. Hotson, I.A.R.O., comes a collection of 43 mammals, 27 birds and several snakes, lizards, etc., obtained in Persia. From Mesopotamia Capt. Pitman, always busy on our behalf, sent us two short-eared owls, 4 spanish sparrows, a common bunting and a desert chat, while Lt. Livesey procured for us a European roller, a blue-cheeked bee-eater, and the skin and skull of a jackal, a most welcome contribution as the Society is anxious to obtain a series of skins and skulls of these animals from Mesopotamia and Persia. Col. Stevens presented us with a teal, a bittern, and one Eastern Baiton's crane. From Capt. Armitage, R.N.R., the Society has received two Sooty or Hemprichs gulls from Aden, a very welcome addition to our collection as this species has been very poorly represented hitherto. Another of these birds was obtained for us at Muscat by Major Husband, I.M.S., while two tessellated water snakes, two Gray's rat snakes, and a dozen scorpions were received from Basra from Col. Anderson.

From within "Indian" limits the Society received a very interesting little collection of mammals from Mr. P. M. R. Leonard obtained on the Burmo-Chinese Frontier, among these were four handsome flying squirrels and a golden cat, two cat bears and two weasels. Mr. C. W. Allen sent us a large Indian civet and a jungle cat from Henzada, whilst a second specimen of the former was together with a Phayres leaf monkey and two Malay vampires obtained for us by Mr. F. C. Purkis of Magwe. A bar-tailed cuckoo-dove from Mr. W. Hannington, Shwebo, and an imperial pigeon and Burmese ring dove from Mr. F. Atlay, Mogok, complete the contributions received from Burma.

Mr. C. H. Dracott sent in a leopard cat and a marmot from Sikkim, the latter skin was damaged, which is unfortunate as specimens of this animal from Sikkim and Tibet are amongst the Society's "wants." A Solitary

Snipe came in from Mr. J. C. Higgins, I.C.S., of Manipur and a Water Cook from Mr. L. O. Clarke, Dibrugarh, Assam.

The Society is much indebted to Mr. H. D. Baskerville, I.C.S., for the skin and skull of a small Indian civet shot in Sind and likewise to Messrs. D. O. Witt and G. Evans for specimens of this animal from Chanda and Jubbulpore respectively. At the request of Mr. R. C. Wroughton, the Society has made special efforts to obtain this civet from Sind and the C. P. A second bittern was sent to us by Mr. F. J. Mitchell, Kashmir, and Major Norman sent down a fine example of the black-tailed Godwit. One John's earth snake was also received from Poona from Major W. S. J. Shaw, while Major H. R. Watson presented us with the head of a cobra in which the "cuneate" scale is wanting.

The Secretary acknowledged the following contributions to the Museum since the last meeting :—

Contribution.	Locality.	Donor.
1 Indian Civet (<i>Viverra zibetha</i>) ..	Henzada ..	Mr. C. W. Allan.
1 Jungle Cat (<i>Felis affinis</i>) ..		
1 Golden Cat (<i>Felis temminckii</i>) ..		
1 Red Cat-bear (<i>Ailurus fulgens</i>)...		
1 Burmese Tiger-Civet (<i>Prionodon maculosus</i>).		
2 Weasels ..	Burmo-Chinese Frontier.	P. M. R. Leonard.
4 Flying Squirrels (<i>Petaurista sp.</i>)..		
4 Rats ..		
2 Squirrels (<i>Sciurus sp.</i>) ..		
1 Water Shrew (<i>Nectogale sp.</i>) ..		
1 Blood Pheasant (<i>Ithagene kuseri</i>)		
1 Jackal (<i>C. aureus</i>) ..	Shaiba, Meso-potamia.	Lieut. T. R. Livesey.
1 Blue-cheeked Bee-eater (<i>Merops persicus</i>).		
1 Roller (<i>C. affinis</i>) ..	Chanda, C. P. ..	Mr. D. O. Witt.
1 Small Indian Civet (<i>V. malaccensis</i>).		
1 Small Indian Civet (<i>V. malaccensis</i>).		
1 Small Indian Civet (<i>V. malaccensis</i>).	Karachi Dist. ..	Mr. H. D. Baskerville.
1 Small Indian Civet (<i>V. malaccensis</i>).	Jubbulpore ..	Mr. G. Evans.
1 Marmot (<i>Arctomys sp.</i>) ..	Sikkim ..	Mr. C. H. Dracott.
1 Leopard Cat (<i>F. bengalensis</i>) ..		
1 Phayres Leaf Monkey (<i>P. phayrei</i>).		
1 Burmese Palm Civet (<i>Paradoxurus burmanicus</i>).	Magwe ..	Mr. F. C. Purkis.
2 Malay Vampire Bats (<i>Megaderma spasma</i>).		
1 Green Imperial Pigeon (<i>Carpophaga aenea</i>).	Mogok ..	Mr. F. Atlay.
1 Burmese King Dove (<i>Streptopelia xanthocyclus</i>).		
2 Sooty Gulls (<i>Larus hemprichi</i>) ..	Aden ..	Capt. Armitage.

Contribution.	Locality.	Donor.
1 Bittern (<i>Botaurus stellaris</i>) ..	Mesopotamia ..	Col. H. Stevens.
1 Teal (<i>Nettion crecca</i>) ..		
1 Eastern Baillon's Crake (<i>Porzana pusilla</i>).		
2 Short-eared Owls (<i>A. accipetrinus</i>).	Do. ..	Capt. C. R. S. Pitman.
4 Spanish Sparrows (<i>P. hispaniolensis</i>).		
1 Bunting (<i>Emberiza sp.</i>) ..		
1 Corn Bunting (<i>E. miliaria</i>) ..	Delhi ..	Major A. H. Cunningham.
1 Falcated Teal (<i>E. falcata</i>) ..		
1 Solitary Snipe (<i>G. solitaria</i>) ..	Imphal, Manipur..	Mr. J. C. Higgins, I.C.S.
1 Water-cock (<i>Gallicrex cinerea</i>) ..	Dibrugarh ..	Mr. L. O. Clarke.
1 Bittern (<i>Botaurus stellaris</i>) ..	Kashmir ..	Mr. F. J. Mitchell.
1 Bar-tailed Cuckoo Dove (<i>Macropygia tusalia</i>).	Shwebo ..	Mr. W. O. Hannyngton.
1 Sooty Gull (<i>L. hemprichi</i>) ..	Muscat ..	Major J. Husband.
1 Black-tailed Godwit (<i>L. belgica</i>).	Risalpur ..	Major A. C. Norman.
1 John's Earth Snake (<i>E. johnii</i>)..	Poona ..	Major W. S. J. Shaw, I.M.S.
1 Cobra (<i>N. tripudians</i>) ..	Nowshera ..	Major H. R. Watson.
2 Tessellated Water Snakes (<i>T. tessellatus</i>).	Mesopotamia ..	Lt.-Col. Anderson.
2 Gray's Rat Snakes (<i>L. ventrimaculatus</i>).		
12 Scorpions		
42 Mammals	Charbar ..	Capt. J. E. B. Hotson.
26 Birds		
16 Snakes		
Lizards and some Insects ..		

STATEMENT of ACCOUNTS from 1st January 1916 to 31st December 1916—contd.

RECEIPTS.	Rs. a. p.	Rs. a. p.	PAYMENTS.	Rs. a. p.	Rs. a. p.
Brought forward ..	4,404 9 0	27,380 13 7	Brought forward ..	.....	89,280 12 11
Grant-in-aid from the Bombay Government ..	5,000 0 0				
Registration fee on Journals ..	78 8 0				
Sundries ..	298 13 3				
Interest on Investments ..	1,651 4 8				
Dividend on Fixed Deposits ..	389 4 0				
Interest on Current Account ..	115 9 6				
Outgoing expenses recovered ..	187 14 5	11,898 15 4			
Total ..		Rs. 89,280 12 11			89,280 12 11
			<i>Securities with the National Bank of India, Ltd.—</i>		
			8½ % Government of India Pro. Notes ..	8,800 0 0	
			4 % Government of India Conversion Loan ..	10,000 0 0	
			4 % Bombay Port Trust Unguaranteed ..	14,000 0 0	
			4 % Bonds ..	15,000 0 0	
			4 % City of Bombay Improvement Trust ..	15,000 0 0	
			Bonds ..	.. ..
			Total ..	Rs. 47,800 0 0	

We have seen a letter from the National Bank of India, Limited, to the effect that the above Securities were held on the Society's behalf on the 31st December 1916.

Examined and found correct.

(Sd.) L. ROBERTSON,

Honorary Treasurer

(Sd.) A F. FERGUSON & Co.,
Chartered Accountants, Auditors.

BOMBAY, 26th February 1917.

BOMBAY NATURAL HISTORY SOCIETY.

MAINTENANCE FUND ACCOUNT.

STATEMENT of ACCOUNTS from 1st January 1916 to 31st December 1916.

RECEIPTS.		Rs. a. p.	Rs. a. p.	PAYMENTS.	Rs. a. p.	Rs. a. p.
To BALANCE ON 31st DECEMBER 1915 ..						
Fixed Deposit with the Eastern Bank, Ltd.		2,500 0 0		By Salary of Mr. N. A. Baptista, Collector ..		540 0 0
Bombay Port Trust Unguaranteed Bonds of Rs. 5,000 at cost		5,150 0 0		" Allowances		276 4 9
Balance per Petty Cash Book		41 8 10		" Travelling and Camp Expenses		01 12 6
" " Postage		28 14 0		" Clothes, &c.		26 0 0
" with the National Bank of India, Ltd. ..		807 4 2	8,535 11 0			
To Donations received during the year 1916 ..		2,438 4 0		By Collecting Expenses		113 0 9
" Interest on Fixed Deposits		100 0 0		" Ammunition		30 0 0
" " on Current Account		19 2 4		" Salary of the Staff		170 0 0
" " on Investment		101 2 4		" Auditors' Fee		30 0 0
" Cost of Gun sold		100 0 0		" General Charges		281 14 3
" Amount refunded by Mr. Pillay		30 7 0	2,882 18 8	" Bank Charges		1 1 0
				" Insurance Premium on Specimens sent to B. M... ..		316 8 0
Carried over ..			11,408 10 8	Carried over ..		849 8 0
						984 1 3

Mammal Fund Account—contd.

RECEIPTS.		Rs. a. p.	PAYMENTS.		Rs. a. p.	Rs. a. p.
Brought forward ..		11,408 10 8	Brought forward ..		848 8 0	984 1 8
			By Income Tax ..		0 8 2	
			" Rewards, &c. ..		314 0 0	
			" Postage Expenses ..		19 4 6	
			" Petty Cash Expenses ..		53 8 0	
						1,141 12 8
			<i>By Balance—</i>			
			Fixed Deposit with the Eastern Bank, Ltd. ..		3,500 0 0	
			Bombay Port Trust Unguaranteed Bonds of Rs. 5,000 at cost ..		5,150 0 0	
			Balance per Postage Book ..		7 9 6	
			" Petty Cash Book ..		38 0 10	
			" with the National Bank ..		697 2 5	
						9,882 12 9
Total ..		Rs. 11,408 10 8				Rs. 11,408 10 8

Examined and found correct.

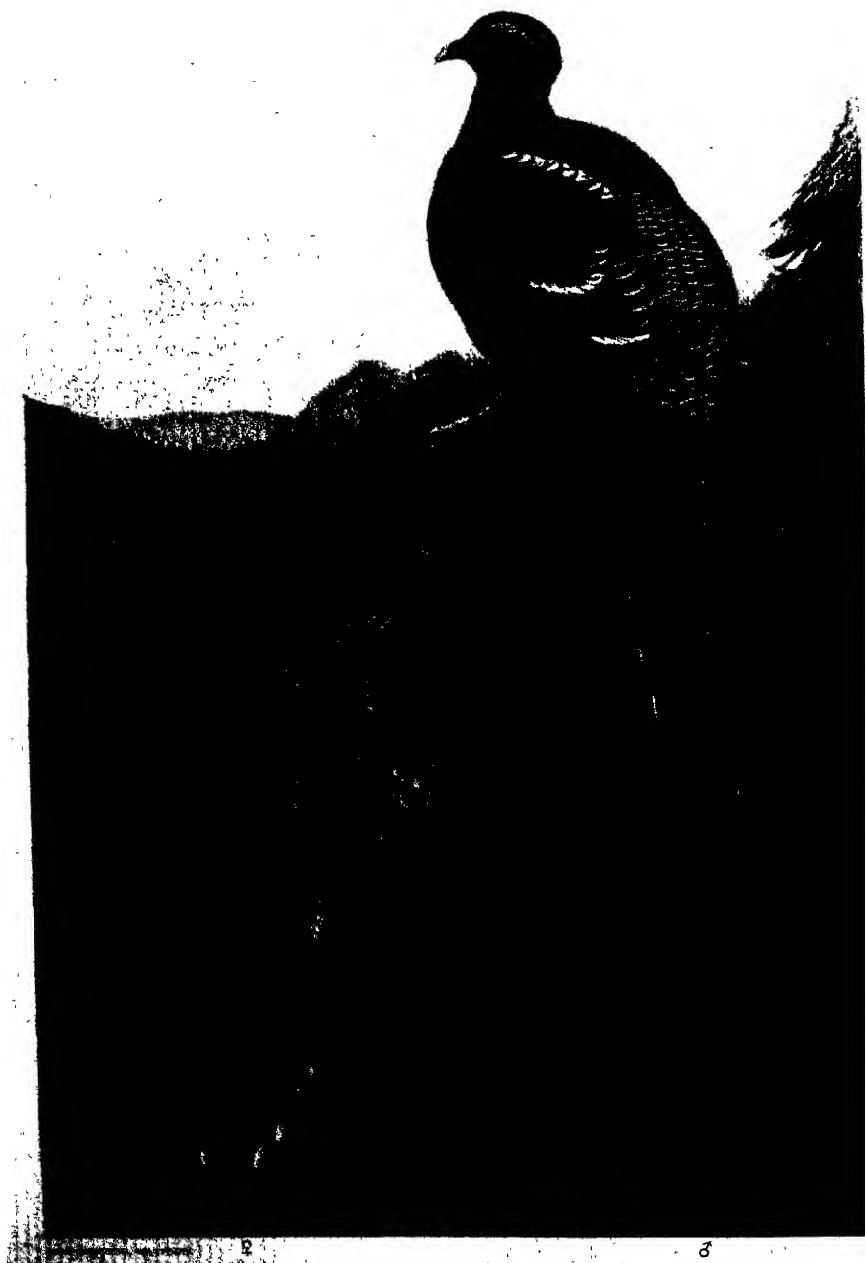
(Sd.) L. ROBERTSON,

Honorary Treasurer.

(Sd.) A. F. FERGUSON & Co.,

Chartered Accountants, Auditors.

BOMBAY, 26th February 1917.



PHASIANUS HUMIÆ.

Mrs. Hume's Pheasant.

JOURNAL OF THE Bombay Natural History Society.

JAN. 1918.

VOL. XXV.

No. 3.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U.

PART XXIII.

With a Coloured Plate.

PHASIANIDÆ.

Genus—*GENNÆUS*.

GENNÆUS LINEATUS LINEATUS.

The Burmese Silver-Pheasant.

Phasianus lineatus, Vigors, Phil. Mag. (1888), p. 147.

Gennæus lineatus, Oates, Str. Feath., V., p. 164 (1877); Ogilvie-Grant, Cat. B. B. M., XXII., p. 304 (1893); Id., Hand-List, Game-B., I., p. 272 (1895); Blanford, Fauna, B. I., IV., p. 92 (1898); Oates, Man. Game-B., I., p. 351 (1898); Id., Ibis, 1903, p. 100; Id., Cat. Eggs, B. M., I., p. 55, P. C. VI., Fig. 5 (1901); Ghigi, Mem. and Acad. Bologna, 6, (v), p. 140 (1908); Evans, Bom. N. H. S. Journal, XVI., p. 520 (1905); Wall, Ibid., XXI., p. 460 (1912); Hopwood, Ibid., p. 1215 (1912).

Phasianus fasciatus, McClell, Calcutta, Jour. N. H., II., p. 146, Pl. III. (1842).

Euplocamus lineatus, Blyth, Cat. Mus. As. Soc. B., p. 244, part (1849).

Gallophani lineatus, Hume, Str. Feath., II., p. 482 (1874).

Euplocamus lineatus, Hume, Nests and Eggs, In. B., p. 525 (1878); Id., Str. Feath., III., p. 165 (1875); Fielden, Ibid., p. 168 (1875); Hume and Marsh., Game-B., Ind., p. 205, Pl. (1878); Hume and Davis., Str. Feath., VI., p. 436 (1878); Anderson, Zool. W. Yunnan, II., p. 669 (1878); Bingham, Str. Feath., IX., p. 195 (1880); Oates, Ibid. X., p. 236 (1882); Id., B of Burma, II., p. 316 (1883); Id., 2nd Edit., Hume's Nests and Eggs, III., p. 416 (1890).

Lophophorus cuvieri, Hume, Str. Feath., III., p. 166 (1875).

Nycthemerus lineatus, Blyth and Walden, Cat. Mam. Birds of Burm., p. 149 (1895).

Euplocamus curieri, Oates, B. of Burm., II., p. 318, part (1883).

Gennaëus lineatus lineatus, Gyldenstolpe, Swedish, Exped., Siam, p. 157 (1816).

Vernacular Names.—Yit, Kayit (*Burmese*); Rak (*Arrakan*); Synklouk (*Talzin*); Phugyk (*Karen*).

Description.—*Adult Male*.—Forehead, crown and crest black, glossed, especially on last, with blue-green or, more rarely, purple blue. Whole of the upper plumage, sides of the neck, wing coverts and exposed portions of the wing quills silver grey in general appearance, palest on the neck and longest tail coverts and darkest on the wing quills and greater coverts. The grey appearance is formed by innumerable fine wavy bars of white on a black ground, these being finest and most numerous on the neck and largest on the wing quills. The primaries are brown with wavy lines of buff or pale brown on both inner and outer webs, these gradually changing colour until the black and white of the inner secondaries is attained. The ends of the upper tail coverts have the white exceeding the black in extent, the longest being almost pure white at their tips. Outer tail feathers black with fine longitudinal lines of buff or buffy white, each succeeding pair having more white and less black, until the central pair, or two pairs, are more or less immaculate over the terminal two-thirds of their length, the fine black lines running further up on the outer than on the inner webs. Below from chin to tail coverts inclusive black, the neck, breast and sides of the flanks more or less glossed with bluish purple; sides of neck, breast and flanks with white centres to the feathers, these white streaks sometimes extending over the greater part of the breast and generally vermiculated with velvety black on the flanks.

Colours of the Soft Parts.—Iris brown, hazel or yellow brown; facial skin and lappets crimson, vivid crimson red or scarlet crimson; bill greenish or yellowish-horny, darker on the culmen and at the base as far as and surrounding the nostrils; legs and feet plumbeous, greenish plumbeous, slate grey, rarely with a greenish brown tinge.

"The legs and feet were generally pinkish fleshy or pinkish brown; sometimes a sort of bluish horny or plumbeous brown."

"The irides seem to vary a great deal; some were brown, of different shades, usually more or less tinged with red; others

"are noted as very pale pink, or even fleshy white." (Hume.)

Measurements.—The series in the British Museum and other specimens which have passed through my hands, in all some 50 birds, shew an extraordinary variation in size, even in birds which are all undoubtedly adult.

Wing from 8.6" (218.4 mm.) to 10.3" (261.6 mm.); tail from 9" (228.6 mm.) to 10.6" (269.4 mm.); bill from front about 1.15" (29.2 mm.) and from gape about 1.45" (36.8 mm.); tarsus 3" to

3·5" (76·2 mm. to 88·9 mm.); the crest runs from about 2·5" (65·5 mm.) to 3·2" (81·2 mm.). The average wing measurement of this series is 9·5" (241·3 mm.).

Hume's measurements given of birds measured in the flesh shew nearly as great variation as the above.

"Length, 25·0 to 30·0; expanse 29·75 to 32·75; tail from vent 10·0 to 13·5; wing 9·25 to 11·5; tarsus 3·0 to 3·62; bill from gape, 1·35 to 1·5; weight 2·5 to 3·0 lbs."

Adult Female.—Whole upper surface of the plumage a golden brown formed by very fine wavy bars of black or blackish brown on a golden buff ground, varying on some birds to a reddish buff; crest rather darker than the rest of the upper plumage with the black bars broader and closer together; feathers of the neck and upper back with white V-shaped marks, narrowly bordered with black; these V-shaped marks are very irregular, and sometimes become mere central white streaks, especially on the upper back; wing coverts and exposed portions of the wing like the back, the primaries and outer secondaries brown on the inner webs. Two central pairs of tail feathers buff with narrow bars of black running across at an angle of about 45° to the shaft, but often practically absent over the terminal half of the inner web of the central pair; outer tail feathers rich chestnut with broad, but very irregular bars of white, bordered with black, and often spotted with the same; these feathers are also mottled with buff at the tips, very slightly so on the outermost, broadly so next the buff central feathers.

Chin and throat smoky buff, changing to rich pale rufous on the breast and flanks, each feather from the neck to the abdomen with a wide lanceolate white streak, edged with black and with more or less black and rufous along the shaft; abdomen and vent dull rufous buff, with a little white mottling; under tail coverts rich rufous, darker than the breast with white streaks centred and edged with black.

Colours of Soft Parts.—Irides brown or wood-brown; facial skin crimson or dull crimson; bill greenish or yellowish horny with darker culmen and black at base to end of nostrils; legs and feet greenish or slate horny, sometimes with a pinkish or fleshy tinge, never red or scarlet.

"Iris dark amber; bill and legs dirty greenish white; skin "of face dark lake." (Wardlaw-Ramsay.)

Measurements.—The Museum series of about a dozen birds and fourteen others measured by me show far less variation in size than occurs in the males, a curious fact, which is confirmed by Hume's measurements.

Wing 8·0" (203·2 mm.) to 9·2" (234·7 mm.); but only one bird has a wing over 9·0" (228·6 mm.); tail 8·5" (215·9 mm.) to 10" (254·0 mm.); tarsus 2·75" (69·8 mm.) to 3·15" (80·0 mm.); bill at front about 1·1" (27·9 mm.) and from gape 1·4" (35·5 mm.).

The average wing measurement of twenty-six females is 8·7" (221·0 mm.).

"Weight 2 lbs. to 2·5 lbs." (Hume.)

The crest is considerably shorter than in the male, varying from 2·2" (55·9 mm.) to 2·75" (69·8 mm.), but is generally about 2·5" (63·5 mm.).

Young Male.—Similar to the adult female.

Chick in Down.—Head above rufous, forehead and above eyes paler; a streak behind the eye extending over the ear coverts rich chestnut, much darker than the crown; above dull rufous brown, darkest along the back and paling on the sides; below dirty buffy white with very faint indications of a chestnut collar at the sides of the breast.

The variations in plumage in the male birds are not great, though in the extreme East and North of its range the markings become somewhat bolder on the upper surface and the extent of white on the sides of the breast and flanks somewhat more plentiful.

The females vary considerably; in many the white markings on the breast are streaks, and not V-shaped marks, the black edges to these marks are obsolete or absent, and the general colour is duller and darker. In some females also the white marks on the upper plumage commence on the nape, whilst in others the forehead and supercilia are freely marked with white. The proportion of black and chestnut on the outer tail feathers also varies extremely, as does the depth of the buff on the central ones.

Distribution.—The fact that on all the boundaries of its habitat this form grades through its various subspecies into *nycthemerus* and *horsfieldi* makes it extremely difficult to define its range with any exactitude. On the West the Irrawaddy undoubtedly divides it from *oatesi*, but at the same time one meets with numerous specimens in the extreme South and East of the Arrakan Yomas which approach typical *lineatus* very closely, and this magnificent river does not form as sharply cut a defining boundary as similar great rivers do with many other species of birds. To the North it extends up to Thaungyi, i.e., 20° about, but West of the Sittang, where the Northern parts are more mountainous it appears only to be found as far North as Thaungoo, Thardoung and Kolidoo. In the higher hills of the Bree Country and again East of the Salwin in the Southern Shan States it is replaced by *sharpai*. West it crosses the Salwin South of Dargwin, and has been reported from Rahang on the M'wang River, but here, on the higher hills at all events, a bird more closely allied to *sharpai* is the common form. South of Muleyit it again appears to wander East across the Klang River, and stretches as far South as 14° and quite possibly much farther South than this, as Grisebache records a Silver Pheasant as far South as 12°.

As regards Siam, its range is very indefinite, and Gyldenstolpe's notes are invaluable; he records

"Silver Pheasants belonging to this species were rather common in the dense evergreen jungles which cover the hills, dividing Tennasserim and Assam. In the neighbourhood of Hat Sauuk (lat. N. 12°) especially, they were exceedingly abundant. . . . During my stay in North-Western Siam I once caught a glimpse of a Silver Pheasant when I was climbing up one of the steep hills at Doi Par Satring (lat. N. 20°). . . . It looked much more white than *G. lineatus*, and was probably *G. nycthemerus ripponi*."

It will be seen from Count Gyldenstolpe's discoveries that the map given on page 62 of Vol. XXIII of the Society's Journal will require some alteration and a great extension of the green colour shewing the area inhabited by this pheasant.

A large amount of material is still required before we can work out the limits of the various geographical races of the Silver Pheasant, and Field Naturalists should remember that very careful minutiae are necessary with the data tickets of specimens to enable the Museum Naturalist to formulate an outline of their different ranges. Thus when birds are got near places on rivers, it is no use merely to mark "shot near so and so", but it is imperative that we should know whether it has been got North, East, South or West of the place mentioned, and that the altitude also be given. In many cases we may get two forms, or even three, within shooting distance of one spot, yet a river may divide two races, whilst the other two may be divided by elevation alone, as appears to be the case in this instance between typical *lineatus* and the two subspecies *catesi* and *sharpei*.

Nidification.—The breeding season of the Burmese Silver Pheasant commences in early March, and continues throughout April and May, but, as usual with this genus of Pheasant, nests and eggs may be found at odd times through a great part of the year. I have records from various sportsmen of eggs taken in February, March and April, and again in July, whilst Capt. Fielden obtained recently hatched young in August at Thayetmyo.

Hume also records eggs having been found in the middle of May. It seems to breed more often in Bamboo Jungles between 2,000 and 3,000 feet than in the heavier jungles and evergreen forests below the former height, or in the lighter deciduous and evergreen forests above the latter.

Its favourite breeding haunts are, perhaps, in the mixed bamboo and light deciduous forest which forms a feature of some of the Pegu Yomas, but the nest itself is nearly always placed in the bamboo patches and not in the forested parts. It is certainly found as high as 4,000 feet during the breeding seasons, and

possibly a good deal higher, but, on the other hand, descends practically to the plains.

The nest is the usual rough collection of leaves and bamboo spates, deposited in some natural hollow and more or less protected by a clump of bamboo, bush or tree. Not infrequently it is placed well under a clump of bamboos in amongst the roots, so that it is completely hidden from the passer by, but at other times it may be found almost in the open. The bird is a close sitter, and will remain on her nest until an intruder is very close, she then, however, sneaks away so quietly and stealthily that it is very easy to overlook her.

The number of eggs laid appears to vary between 5 and 10, whilst 6 or 7 are the number most often found in a complete clutch. The statements of natives quoted by Hume, to the effect that these Pheasants sometimes lay 14 or 15 eggs appear to be without any foundation.

The eggs are typical *Gennetus* eggs, that is to say like small eggs of a domestic fowl. Hume thus describes them :

"All the eggs we have obtained are of the usual hen's egg shape; they are, of course, unspotted, and vary from a pale yellowish to a warm pinkish café-au-lait colour. The shell, though fine, is very full of pores, and these with some eggs being filled with whitish chalky substance, give them the effect of being stippled all over with white specks. None of the eggs that I have seen have had any very perceptible gloss, and as a rule, they seem to be, for game birds of this class, very dull eggs."

"The eggs vary from 1.81 to 2.03 in length, and from 1.4 to 1.52 in width, but the average of nearly 30 eggs is 1.97 by 1.46."

The few eggs I have seen including some of those described by Hume which are now in the British Museum, agree well with the above description, but the eggs strike one as being singularly level in colouration. All are a pale stone buff, varying very little in depth of colouring, and I have seen none which would really come under Hume's description of "warm café-au-lait." A few have a tinge of this colour and one pretty clutch of 6, given to me by Mr. Wickham, is quite a bright, though pale, pinkish buff.

The texture is fine and close with a faint surface gloss in fresh eggs, and the shell is very stout and compact. My series, a poor one combined with Hume's and others gives a much smaller average size, 1.86" x 1.42" (47.3 x 36.1 mm.), than that recorded above.

Oates says that :

"The chickens, as soon as they are hatched, are very strong on their legs and run with great speed. I was fortunate enough to capture portions of four broods. It is astonishing

“in what a short time the little birds make themselves invisible. It is difficult to secure more than two birds out of one batch. It is a case of pouncing on them at once or losing them. The mother is a great coward, running away at the slightest alarm, and thus contrasting very unfavourably with the Jungle Fowl which keeps running round and round the intruder with great anxiety until the young ones are in safety.”

General Habits.—The prevailing colouration of this Pheasant gives an excellent clue to its haunts and the general character of the country it inhabits. It is not to be found in the humid, ever-green forests beloved by the Black-Backed Kalij which finds concealment in their black depths as deep in shade as its own sombre plumage. Nor on the other hand must it be looked for in the high open grasslands frequented by the whiter forms of the Chinese Silver Pheasants whose pure whiteness find no great contrast in the sunlit grasses round them. As might be expected, the Burmese Silver Pheasant, with its dark silver upper plumage, will be found either in thin deciduous forest or in bamboo jungle. Here the glare of the tropical sunlight is filtered and broken by the intervening branches into thousands of specks or spots, bold bars and dashes of alternate light and shade of gleaming white, grey, or black. In such places with every passing breath of air the whole medly quivers and melts into an ill-defined greyness much like that on the back of the bird itself.

Davison, writing of the true *lineatus* from the neighbourhood of Moulmein, says:—

“They come continually into the open to feed about rice-fields and clearings. They are shy, and usually run in preference to flying when disturbed, except when put up by a dog, when they immediately perch. Captain Bingham tells me that on bright moonlight nights they constantly come out into the clearings. Their food consists of grain, seeds of various kinds, young leaves and grass, grubs and insects.”

“They seem to prefer bamboo, or moderately thin tree jungle to dense forest.”

Oates' description does not agree well with the above in all respects, as he writes of it as a rather tame bird averse, however,

“to all cultivation, even to the extent of shunning the *yaks* or hill gardens of the Karens, though these may be some miles from the nearest *tay* or village.”

He writes of this Pheasant's favourite haunts as follows:—

“It is rare or common just in proportion as the country is level or mountainous. In the plains or undulating country of Upper Pegu it will be met with in small numbers if the ravines and nallas are sufficiently precipitous to suit its tastes;

"but in these places, at best, only one or two will be shot in a long morning's work. It is not till we get to the foot of the hills that this Pheasant can be said to be common. Here the nallas, with their pools of water and rocky beds, are particularly favourable to it. As we mount higher it increases in numbers to such an extent it is no difficult matter to knock over half a dozen in a morning while marching, and that without leaving the path."

During the breeding season the cock Pheasant of this species indulges in the same form of challenge to other cocks as that already described in regard to previous species, *viz.*, the drumming sound made by beating the wings against the sides of the body as the bird sits on some elevated position, such as an ant heap or some log or stump.

Oates says that the sound of the birds' wings may be very fairly imitated by holding a pocket handkerchief by the two opposite corners and then jerking one's arms apart, and he adds that he has himself on two occasions shot cock birds running excitedly towards the sound thus made.

Davison also refers to this method of challenge, which he calls buzzing, and remarks that the Burmans trap a great number of these Silver Pheasants by the aid of a decoy bird which is induced to "buz" and so call up other males around him, when they are caught in the nooses laid down for this purpose.

Like all Kalij Pheasants the Burmese Silver Pheasant is an inveterate skulker, and without a dog it is almost impossible to make them take to wing as they scuttle away to safety on foot with great speed. With a dog they are easy to flush, but even then when put up they, like the rest of their tribe, generally take to a tree or bamboo perch and then glide away from the opposite when the would-be shooter approaches.

The easiest way to get them where they are at all numerous is to wander along the edges of cultivation, or along some jungle path in the early mornings and evenings and trust to luck to coming across them and getting a snap-shot as they run for the nearest cover.

Of course, sometimes, the birds can be forced by beaters out of isolated patches of cover, and when such a proceeding is possible, fair sport may be had as the birds fly well when once started. Like most pheasants—indeed, like most game birds—they fly down-hill but always run up-hill when disturbed.

Although Oates found it very hard to rear the young, others have been more successful, and I am informed that they become very tame and domesticated, though if allowed to run loose, they generally disappear when the breeding season approaches.

They feed on both grain and other vegetable food and on insects. The ants, or Termites, and ordinary ants are a very favourite food

and they also consume grasshoppers, beetles, worms and other similar forms. Shoots of many plants, all grain, bamboo and grass seeds, the different *Pici*, which are so plentiful in all Indian forests, yams, ginger and other ground roots all contribute at various times to their support.

They are said to be good for the table, but rather dry, though tender enough if eaten when killed or if hung for two or three days.

The males have a short harsh crow which, however, cannot often be used, for most writers make no reference to it, and Oates says that the only sound he has heard them utter is a low chuckle frequently uttered, both when the bird is alarmed and when it is going to roost.

GENNAEUS LINEATUS OATESI (Ogilvie-Grant).

Oates' Silver Pheasant.

Gennaëus oatesi, Gilve-Grant, Cat. B. M., XXII., p. 306 (1893); id, Allen's Naturalist's Lib. Game-B., I., p. 276 (1894); Oates, Game-B., India, I., p. 348 (1898); Oates, Ibis, 1903, p. 103; Ghigi, Mem. Acad. Bologna (6), V., p. 141 (1908).

Gennaëus lineatus oatesi, Stuart Baker, B. N. H. S. Jour., XXIII., p. 677 (1915).

Vernacular Names.—Yit (*Burmese*), Rak (*Arrakan*).

Description.—*Adult Male.*—Similar to *lineatus lineatus*, but with the vermiculations on the upper parts slightly bolder and better defined, though running across the feather as in that bird, and not following the contour as it does in the more Eastern and Northern forms. There is still a faint indication of the barring on the rump, though this differs in extent in different individuals. In a male from Thazi-Thaungi this barring is quite strongly developed, but in the type, which is merely labelled Arrakan, the rump bars are very faint, though still sufficiently plain to contrast with the back. The sides of the breast are well streaked with white.

Colours of the Soft Parts.—Apparently similar to those of the Burmese Silver Pheasant. "The legs are brown or dark flesh colour, and the skin of the face is crimson." (Oates.)

Measurements.—Wing 9.2" (233.7 mm.); tail 11.6" (294.6 mm.); tarsus 3.35" (85.1 mm.); spur 1.0" (25.4 mm.); bill from forehead 1.3" (33.0 mm.) and from gape 1.4" (36.0 mm.); crest 2.2" (55.4 mm.).

I have only been able to obtain the measurements of three males.

Adult Female.—Differs from that of *horsfieldi* in having the whole tail chestnut brown or chestnut rufous, barred irregularly both above and below with brown. Of the three specimens in the British Museum Collection, two have the rectrices a dull pale chestnut brown, and the third has them a chestnut rufous. In each case the

central rectrices are somewhat paler and more of a rufous buff than the others, but not sufficiently so to cause them to contrast with the other as they do in *horsfieldi* in similar cases. The type female has no pale markings on the back, but is redder than are most female *horsfieldi*, the two others are both marked with these central pale striæ, though to a less degree than in *lineatus*. All have pale buff striæ on the breast and flanks instead of white striæ as in *lineatus*.

Colours of Soft Parts.—Not recorded, but probably similar to those of *lineatus*.

Measurements.—Wing 8.1" (205.7 mm.); tail 8.3" (210.8 mm.); tarsus 2.9" (73.6 mm.); bill at front 1.2" (30.5 mm.) and from gape 1.4" (36.0 mm.); crest 2.15" (54.6 mm.).

Distribution.—The Arrakan Yomas from about 20.5° lat. in the North to the extreme South of Arrakan. To the East its boundary is the Irrawaddy River, which divides it from the area inhabited by the true *lineatus*.

The dividing line between Oates' Silver Pheasant and the Black-Backed Kalij is not easy to define, for wherever there are dense evergreen forests with low-lying well-watered valleys the latter bird is found encroaching South into the Arrakan Yomas; next these haunts of *horsfieldi*, we find a number of birds with an extraordinarily varying plumage, scattered here and there over a very narrow and broken area. These birds I previously accepted as a subspecies under the name of *cuvieri*. Now, however, I find that it is impossible to allocate to this supposed subspecies any definite range in which there is a consistent type of plumage obtainable, it is also impossible therefore to permit it to rank as a geographical race or subspecies and it must be suppressed.

The reason is merely that in the North-West the transition between *oatesi* and *horsfieldi* is abrupt because the climate and geographical factors also vary abruptly, and in consequence it has been impossible for a staple or permanent form to establish itself over any definite area intermediate between the two.

In the North-East of its range the change between *oatesi* and *williamsi* is very gradual, as are the geographical changes, but in the centre between the two there is some very dry country, too dry even for the grey forms of Silver Pheasant, so that we have a well-defined area into which no pheasant penetrates, except as a straggler, and on the outskirts of this dry area we have the two good subspecies *williamsi* North and *oatesi* South.

Nidification.—There is at present nothing on record concerning the breeding habits of Oates' Silver Pheasant beyond the fact that Capt. Fielden obtained young birds in August near Thayetmyo in Central East Arrakan.

The birds appear to breed principally in March, April and May,

and the few eggs in my collection have been taken in these months between the 20th March and the 10th May. The nests, as far as one knows at present, are always placed in bamboo forest or in the thick secondary growth which so quickly covers deserted cultivation patches in the same forest. It is quite possible that they have two broods in the year, though I do not think this is usual with birds of this genus.

Probably a full clutch of eggs is nominally 7 or 8 as in the other pheasants, but I have so far only records of 3 to 5 eggs, undoubtedly, with one exception, incomplete clutches.

They are exactly the same in every respect as the eggs of *lineatus lineatus*, and the average in size of 10 eggs 47.0×37.1 mm.

General Habits.—Capt. Fielden writes regarding Oates' Silver Pheasant, though he did not differentiate between the various forms of *lineatus* :—

"This bird is tolerably common in the hills West of Thayetmyo, but appears to be unknown to any but Burmese. It seems to require rock and very steep hillsides, covered by long grass for shelter, and flat alluvial soil, bare of grass and covered with brushwood and young trees, for feeding ground; in fact, its feeding ground is exactly the same as that of the Black Woodpecker, and I have several times lost a bird of each species by being undecided which to fire at.

"An old male is a most extraordinary looking bird. The tail only is seen moving through the long grass, and I invariably thought at first that it was some new porcupine or badger, or some animal. The note, too, adds to the deception. It reminded me a little of the cries of young ferrets.

"They run with great rapidity, but rise readily before a dog, and would not be difficult shooting, but for the steepness of the hillsides upon which they are found, and the nature of the soil,—gravel just stuck together with the material that forms the petrified wood so common there. This covered by grass or dried bamboo leaves makes the footing so slippery that any attempt to raise my gun hurriedly generally brought me to my knees.

"These birds feed a great deal on the young shoot of a kind of Orchis, which rather resembles a large Roselle flower, and its juicy leaves enable these pheasants to live for some time far away from water; but in the middle of the hot weather they are forced to retire from the Thayetmyo Hills by the long grass being burnt. They return at the beginning of the rains. They hatch in August."

To the above I can add but little, but most of my correspondents, who know these birds and their haunts, seem to consider them birds which do require to have water within reasonable reach for their

morning and evening drink. Their flesh is said to be good, though rather dry, and perhaps inferior to that of the Jungle Fowl shot in the same jungles.

Mr. J. P. Cook, writing from the same place as Capt. Fielden, but in 1912, more than thirty years later, says that this pheasant is still very common there, and that in a comparatively short time he shot some thirty specimens, but could only preserve three, two males and one female. He found them frequenting either the same descriptions of cover as that described by Capt. Fielden or in bamboo covered slopes. They were most common between 1,000 and 2,000 feet, and did not appear to be birds of high elevation, though they were, on the other hand, sometimes found on the plain at the foot of the hills.

GENNÆUS LINEATUS SHARPEI (Oates).

Grant's Silver Pheasant.

Gennæus sharpei, Oates, Man. Game-B. I., p. 357 (1898); Oates, Ibis (1903), p. 101; Ghigi, Mem. Acad. Bologna (6), V., p. 140 (1908); C. S. Barton, Journal Nat. Hist. Soc., Siam, I., p. 108 (1914); Stuart Baker, Jour. B.N.H.S., XXII., p. 678 (1915); Guildenstolpe, Swedish Exped. Siam, p. 157 (1916).

Vernacular Names.—Yit (*Burmese*).

Description.—*Adult Male.*—Similar to the male of the Common Burmese Silver Pheasant, but the lines on the upper surface are well defined regular black and white lines following, for the most part, the contour of the feathers; even on the neck next the bare crimson face the markings could hardly be called vermiculations, whilst the lines on the sides of the neck lower down are quite distinct. At the same time the black bars and lines are not so far apart as they are in *rufipes* and, broadly speaking, *sharpei* may be said to be more black and white than *lineatus*, but less white in general appearance than *rufipes* and its other neighbours East and North of it.

Colours of Soft Parts.—

"Facial skin deep crimson; bill pale bluish horny; legs and feet dark pinkish fleshy." (Davidson.)

"Large reddish horny." (Cook.)

A male taken by Herbert's collectors at Korat is described by him as having the "facial skin red, irides brown, legs bright red."

Measurements of Type.—Total length 30.0" (Davidson). Wing 9.8" (249.0 mm.); tail 13.9" (353.0 mm.); tarsus 3.4" (86.3 mm.); spur 1.3" (33.0 mm.); bill from forehead 1.4" (35.5 mm.) and from gape 1.6" (40.5 mm.). "Weight 2.75 lbs." (Davidson).

A second male presented by J. C. Cook, Esq., had a wing of 9.9" (251.5 mm.) and a tail of 14.0" (355.5 mm.). The crest is short, (1.5" (38.1 mm.)) or more.

Adult Female.—The type specimen obtained with the male can only be distinguished from the female of *lineatus* by the great breadth of the white marks on the lower surface of the body. Three females obtained at Muleyit and a fourth shot with the male obtained by Mr. P. C. Cook, all have the lower parts much darker than in any specimen I have ever seen of *lineatus*. The chestnut or rufous is in fact almost entirely absent on the lower plumage, and the feathers may be described as smoky black or dull dark brown with broad white centres not V-shaped.

It will probably be found that the lower plumage of the female ranges from a red, little darker than that of *lineatus* to the deep smoky brown of the Muleyit birds.

Colours of the Soft Parts.—"Facial skin deep red; irides brown, bill pale horny colour; legs, feet and claws pinkish brown." (Davidson).

Measurements.—"Expanse 29.75"; length 23.5"; weight 2.25 lbs." (Davidson).

The measurements of the five females referred to above are as follows:—Wing from 8.4" (213.3 mm.) to 9.5" (241.3 mm.); tail from 8.9" (226.0 mm.) to 10.5" (266.7 mm.); tarsus about 3.0" (76.2 mm.); bill at front about 1.25" (31.7 mm.) and from gape about 1.45" (36.8 mm.); the crest is about 2.2" (55.8 mm.) or rather less.

Distribution.—The distribution of this fine subspecies is not yet known with any certainty, and much more material is required before one can say where it meets *lineatus* on the West and South, *rufipes* on the West and North and *ripponi* on the North. Where it meets other forms to the East is still quite unknown. Its range would appear to run from Dargwin North a little way into the South Shan States, East over the Sittang and Mewang Rivers at least up to the Mennam River; South to Rareng and Muleyit and possibly in the higher hills as far as the 15° latitude.

In the North, Gyldenstolpe saw a bird at Doi-Par-Saken which he describes as being too white to be of this subspecies, and as nearer *ripponi* in its very white appearance. To the South on the 14° latitude at both M. Rat Bouri and M. Petcha Bouri the true *lineatus* is said to be common. It will probably be found to run up towards the Mekong River, but as yet the Silver Pheasants of this part are not known, and it is not possible to say where Grant's Pheasant will meet the forms known as *annamensis* and *beli* which are found in Annam and South-East Siam.

The furthest point to the South-East at which we know it to be found is the Korat Hills which lie roughly 15° latitude by about 101°—102.5° longitude. At this place Pheasants of this subspecies were obtained by Mr. E. G. Herbert's Dyak collectors, the males of

which were fairly typical *sharpei*, but the females of which shewed a near approach to true *nycthemerus*.

Nidification.—Nothing recorded.

General Habits.—Nothing recorded.

Apparently this bird is not uncommon between 2,500 and 4,500 feet on the Hill Ranges within the limits of its habitat as described above, but it is such a skulker that it is still very little known, even by the few Europeans who have worked this part of the country. Messrs. E. G. Herbert, Williamson and others have done their best to obtain specimens, as also have Kloss and Robinson, but with little result. It would appear to be a form of *lineatus* replacing this bird in the higher, more open hills, especially on those hills which have more or less wide expanses of grass-land covering their crests and sides.

They stand captivity well, and Mr. Herbert has been successful in keeping adult birds for some time.

GENNÆUS NYCTHEMERUS NYCTHEMERUS.

The Chinese Silver Pheasant.

Phasianus nycthemerus, Linn. S. N., I., p. 272 (1768); Latham, Ind. Orni. II., p. 631 (1790).

Euplocamus nycthemerus, J. E. Gray, III., Ind. Zool., II., Pl. 38, Fig. 2 (1834); Blyth, Cat. Mus. As. Soc., p. 244 (1849); Gray, Hand-L., II., p. 260 (1870).

Gallophasias crawfordii, Gray, Gen. Birds, III., p. 498 (1845).

Gallophasias nycthemerus, Gray, Gen. Birds, III., p. 498 (1845).

Euplocamus nycthemerus, Gould, B. of A., VII., Pl. XVII. (1859); Elliot, Mon. Phas., II., Pl. 21 (1872); David and Ous., Oiseaux Chine, p. 416 (1877).

Gennæus nycthemerus, Ogilvie-Grant, Cat. Birds, B. M., XXII., p. 307 (1893); id., Hand-List Game-B., I., p. 277 (1899); Oates, Cat. Eggs B. M., I., p. 55 (1901); Ghigi, Mem. Acad. Bologna (6), V., p. 138 (1908); Ingram, Nov. Zool., XIX., p. 270 (1912); Stuart Baker, Journal B. N. H. S., XXIII., p. 379 (1915).

Vernacular Names.—Yit (*Burmese*), Wuri (*Kachin*).

Description.—*Adult Male*.—Forehead, crown and crest black with a strong purple sheen; nape to end of upper tail coverts white with from 5 to 7 narrow wavy lines of black on each web following the outline of the feather, but completely dominated by the white ground; on the nape the lines are comparatively faint, and on the ear coverts and sides of the neck obsolete or entirely wanting. Whole visible portions of the wing like the back, but with only two to four lines on each web of the feathers, and these lines stronger and bolder than those on the back, tail with the two, three, or even four central pairs white, with a few irregular broken longitudinal lines on the bases of the outer webs; tail feathers white with two or three bold black lines on each web; intermediate feathers grading

from one to the other. Below from chin to end of under tail coverts velvety black with a deep purple-blue gloss.

Colours of Soft Parts.—Irides brown or red-brown; bill greenish or yellowish horny, the culmen and base darker; bare facial skin bright crimson red to almost vermilion red; legs brilliant coral red.

Measurements.—Wing from 9·8" (248·9 mm.) to 10·8" (274·3 mm.), the average being 10·3" (261·6 mm.), tail from 21·6" (548·6 mm.) to 27·8" (706·1 mm.) in fully adult birds; tarsus from 3·75" (95·2 mm.) to 4·0" (101·6 mm.); bill at front 1·2" (30·4 mm.), and from gape about 1·5" (38·1 mm.). The crest varies between 3" and 3·5" (76·2 and 88·9 mm.), being generally well over 3·2" (81·2 mm.). The spur is generally well developed and runs from about ·75" (19·6 mm.) to 1·2" (30·4 mm.), being generally well over the inch in full-grown birds.

Adult Female.—Whole of the upper plumage golden brown, the edge of each feather slightly darker, and with everywhere a powdering of dark brown, so minute as to be hardly visible without a close examination; terminal half of crest black, gradually grading into the brown of the crown. Two central pairs of tail feathers pale ashy buff, marked with fine broken bars of dark brown, lateral tail feathers black with straggling broken lines of white. Below, chin and upper throat pale ashy, changing to ashy brown on the lower throat and upper breast, the latter becoming paler and much mottled with brown spots and bars; lower breast still paler and with bolder bars and markings; remainder of lower plumage and flanks rather dingy white with bold, broad bars of dark brown; centre of belly and vent duller, and with fine bars of brown instead of broad ones.

Colours of Soft Parts.—Irides brown, golden brown or hazel; bill greenish or yellowish horny, pale at tip and dark at the base of the upper mandible; facial skin bright crimson red, crimson or dull crimson; legs brilliant coral red.

Measurements.—Wing from 8·8" (203·5 mm.) to 9·9" (251·4 mm.), with an average of 9·2" (233·6 mm.); tail from 9·8" (248·9 mm.) to 12·3" (312·4 mm.), generally about 11" (279·4 mm.); tarsus about 3·5" (88·9 mm.); bill at front about 1·1" (27·9 mm.), and from gape about 1·4" (35·5 mm.); the crest, which is rather meagre and thin, runs up to nearly 3" (76·2 mm.), and is usually about 2·5" (63·5 mm.).

Young Males and Females in First Plumage.—Similar to the above, but with the whole of the lower parts from throat to under tail coverts more or less uniform buffy brown, varying in depth from a pale, almost albescent buff (see B. M. specimen, No. 39·4.15.66.) to a deep umber, almost chocolate brown (see B. M. specimen No. 1907. 12. 31. 121.). In all specimens the shafts are paler than the webs, and shew up as faint or conspicuous streaks according to the depth of colouring adjoining.

The extent of mottling, vermiculations, or bars on breast, flanks and abdomen seems to vary in every individual; in some they are hardly perceptible, in others the centre of the breast and abdomen alone is faintly mottled or vermiculated, in others again the greater part of the lower plumage is thus marked, while in one or two the buff or brown is broken up everywhere with comparatively bold barrings or spots as well as with a sprinkling of white.

It would appear that these Pheasants take at least two years to acquire their full plumage, and that even the females go through the three moults before acquiring the beautiful black and white, or deep brown and white, under plumage.

Young Males in Second Plumage appear to resemble the females in adult plumage, and to go through the same variations and phases, though in some cases they moult direct from the first to the final plumage, and in others go through two moults to acquire this without ever assuming that of the adult female.

There are two young males in the B. M. Collection, one from Kuantun, and one from Canton, which appear to be changing from the mottled plumage into the adult, though it is evident that this moult would not have been complete for the feathers are parti-coloured, many shewing adult black bases and juvenile mottled tips. On the other hand a young male specimen of the subspecies *ripponi* shews that it is changing from the more uniform juvenile garb direct into the adult black and white.

At the same time some young birds in the possession of Mr. E. G. Herbert in Siam, which were brought in as young birds of the year, moulted in the same autumn into the complete male plumage without any intervening stage.

A very remarkable fact about Mr. E. G. Herbert's birds was that prior to moulting some of the feathers appeared to have assumed a partial adult colouration by the pigmentation of the dead feathers; these became marked with white or with black, the same in depth and tone as the feathers which came in their place.

Distribution.—"South China, Fokien, Chinkiang" (Grant). In my Review of this genus I wrote that "the Chinese Silver Pheasant appears to be found from latitude 28° to about latitude 22° on the Eastern watershed of the Salwin, but not in the lower lying country adjoining the river between latitude 22° and 24°." "Salwin" is, of course, a *lapsus calummi* for Mekong, West of which River within the latitudes given the Chinese Silver Pheasant is not found.

It is possible that when the range of habitat of this Pheasant has been more completely worked out, we shall have to extend the area into the Northern part of the South and West of the Mekong to latitude 19-50° or even higher.

About the neighbourhood of the Mekong we get a form of Silver

Pheasant which appears to be most closely allied to *sharpei* as do other specimens obtained by Mr. E. G. Herbert at Korat (lat. 15°, long. 102·5°), but these latter birds have brilliant red legs, and not fleshy grey or fleshy livid ones as in *sharpei*.

There still remains a great deal to be done in Siam and the adjoining countries before we can definitely lay down the areas occupied by the various subspecies of *Gennæus*.

General Habits.—The Chinese Silver Pheasant is normally an inhabitant of the highest and driest hills and plateaus above 6,000 feet and up to 9,000 feet or more. Also, as we should expect, it haunts the more open forests or country which is grass-covered and only intersected with forest by the lower lying valleys and ravines. It is doubtful whether this Pheasant ever really enters any part of the area covered by these articles, and it cannot be considered an Indian bird; at the same time the dividing line in appearance between true *nycthemerus* and its subspecies *ripponi* is so narrow that we may eventually find that the latter cannot stand, and, in this case, the bird will then have the status of an Indian, or rather, Burmese, Game-Bird.

GENNÆUS NYCTHEMERUS RIPPONI.

The Yunnan Silver Pheasant.

Gennæus ripponi, Sharpe, Ball, B. O. C., XIII., p. 29 (1902); Ghigi, Mem. Acad. Bologna (6), V., p. 139 (1908); Harington, Jour. B. N. H. S., XX., p. 377 (1910); Stuart Baker, *ibid*, XXIII., p. 384 (1915).

Gennæus jonesi, Oates, Ibis (1903), p. 97; Ghigi, *in loc. cit.* (1908).

Vernacular Names.—Yit (*Burmese*), Wuri (*Kachin*).

Description.—*Adult Male*.—Only differs from true *nycthemerus* in having the black bars a trifle broader in comparison so that the upper parts at a short distance do not appear to be so pure a white. The sides of the neck are seldom so pure a white as they are in the Chinese bird, the tiny black vermiculations being more numerous and more pronounced. The tail also averages shorter.

Colours of the Soft Parts.—As in *nycthemerus*.

Measurements.—Wing 10·1" (256·5 mm.) to 11·9" (302·2 mm.); tail about 18·0" (457·2 mm.) to nearly 25" (635 mm.); tarsus 3·75" (95·2 mm.) to 4·05" (102·8 mm.); spur up to 1·25" (32·7 mm.), and nearly always over an inch (25·4 mm.); crest from 3" (76·2 mm.) to 4" (101·6 mm.). The average length of wing of twelve adult males is 10·9" (276·8 mm.), and of tail 22" (558·8 mm.). The bill at front is about 1·2" (30·4 mm.) and from gape about 1·5" (38·1 mm.).

Adult Female.—To the extreme East of its range closely resembles the females of *nycthemerus*, but appears never to have so much white

on the lower plumage and always to have a certain amount of rufous barring on the feathers like the hen of *rufipes*. To the East of its range the female more closely approaches *rufipes* and has still less of the white and more of the rufous barring below. The tail is on an average decidedly longer than that of the Ruby Mines Silver Pheasant, yet shorter than that of the Chinese bird. I have been able to examine very few females of this species, but the colours of the soft parts and the dimensions seem to agree with those of the Chinese Silver Pheasant.

Distribution.—This subspecies is confined to the inter Salwin-Mekong country from latitudes 21° to 25° certainly; possibly further North than the former and probably further South than the latter. Where this bird meets *sharpai* is at present unknown, but there is probably a line where the two subspecies meet, and are not definable one from the other, on the ridges and hills which run East and West from Karen-nee to Doi-par-Sakem, or a little South of this in Siam.

Nidification.—Nothing known.

General Habits.—So far nothing has been recorded of the habits of this very doubtful subspecies, which will not, however, be found to differ in any respect from those of true *nycthemerus*. Like that bird it is found on hills covered either with a sea of grass, with light deciduous forest, or in places where these are mixed with and broken up by ravines and pockets of more dense jungle, often more or less evergreen in character.

It appears to prefer wide stretches of grass-land bordered by forest in which it can conceal itself in case of necessity, and especially does it haunt such as are rough and rugged and a good deal broken up with out-crops of rock. It is not, as far as is known at present, found below 5,000 feet elevation, and is found up to the highest altitudes of 9,000 feet or more; that is to say, this bird, a trifle darker in general tint than its Chinese relations, is also found at slightly lower elevations.

It would appear to be most common in Yunnan in the Trans-Salwin Hills at about 7,000 feet, where it is found in great numbers in the thin oak forests which are scattered about in small patches in the higher grass-lands, and where the only really dense vegetation is to be found in the wild tangles of growth on the borders of some of the streams and in the larger ravines.

Writing of such a country as this, a correspondent says in *epistola*.—

"I'm afraid I cannot give you nearly as much information about this beautiful bird as you may expect. In spite of its being found generally in grass rather than in heavy trees or thick cover, it is not so easy to find, and still less easy

“to bring to bag when once found. One imagines that such a magnificent bird must be extremely conspicuous wherever found, but such is by no means the case, and I have more than once stared at a motionless bird some seconds before I could make it out. The stunted and thinly foliaged oaks which are scattered about at some distance from each other give such a queer dappling of light and shade under the blazing Indian sun that the outline of even glaring white objects cannot be made out at once, and the broken black and white of the Pheasants’ back assimilates well with the waving grass and the shivering broken shadows of the oak-leaves. Every breath of wind which stirs grass and leaves alters your view, and it is not until the bird rushes headlong away in the open or skulks, head and tail down like some wild beast, into the nearest raspberry tangle that you grasp the fact that you have let a pheasant get away.

“Of course, once they are on the wing they can be seen and heard from a great distance, but even under these circumstances I have been sometimes so struck with their beauty that I have failed to fire until too late.

“One of my first encounters with these birds was when working over the crest of a grass ridge with my sepoy, we suddenly put up a covey of full-grown birds, and I was so fully occupied in watching these streaks of silver loveliness that I omitted to fire at all, and the whole lot—I think there were 7 or 8—disappeared, unharmed down the hill into a ravine with tree and dense undergrowth.

“Often we used to hear these Pheasants moving in front of us as our scouts worked through the grass on either side of our track the main body of our men were following, but we very seldom put them up within sight. When we were working up-hill they continued to run ahead of us until they had crossed the ridge or crest of the hill to our front, and then, when out of sight, they took to wing with much fluster and noise.

“We noticed they always ran up-hill and flew down, and always seemed to make for the highest point in the vicinity before taking to flight.

“As on the occasion of which I just wrote we several times came on coveys of full-grown cock birds without a single hen anywhere near that we could see; it may have been that the hens had skulked away on foot, but I think not, for the sound of the running birds could be followed very clearly when the grass and fallen leaves were dry and rusty.

“They crowed much like the common English Pheasant, but a shorter, deeper sound. I never *saw* them crowing,

"but more than once put up cock birds from spots where I had heard a vigorous crowing and flapping of wings going on the moment before.

"They are not bad eating, but not nearly so tasty as our home birds, but then they had not the advantages of hanging, sauces, &c., except the one sauce, 'hunger.' The flesh was very white, rather dry and, of the old birds, horribly tough. One or two hens we shot and ate were much nicer than the cocks.

"We never found their nests, eggs or young, but it might not have been the right season for them."

GENNÆUS NYCTHEMERUS RUFIPES.

The Ruby Mines Silver Pheasant.

Gennæus rufipes, Oates, Man. Game-B., I., p. 362 (1898); id. Ibis (1903). p. 97; Ghigi, Mem. Acad. Bologna (6), V., p. 139 (1908).

Gennæus atlayi, Oates, Ann. and Mag. Nat. His. (8), V., p. 162 (1910).

Gennæus granti, Oates, Ann. and Mag. Nat. His. (8), V., p. 163 (1910).

Gennæus assimilis, Oates, Jour. B. N. H. S., XVI., p. 114 (1904); Oates, Ann. and Mag. Nat. His. (7), XIV., p. 286 (1904); Ghigi, Mem. Acad. Bologna (6), V., p. 141 (1908).

Gennæus elegans.

Gennæus affinis, Oates, Ann. and Mag. Nat. His. (7), XI., p. 231 (1903); Ghigi, Mem. Acad. Bologna (6), V., p. 143 (1908).

Gennæus nycthemerus rufipes, Stuart Baker, Jour. B. N. H. S., XXIII., p. 680 (1915).

Kalij Pheasants, Finn. and Nisbett, Jour. B.N.H.S., XIII., p. 521.

Vernacular Names.—Yit (*Burmese*), Wuri (*Kachin*).

Description.—*Adult Male*.—Similar to *G. n. ripponi*, but still darker, the black lines and bars on the upper plumage being broader and more numerous, especially on the tail. The sides of the neck are less pure white, and as a rule are profusely vermiculated all over with fine, wavy bars of black. The tail is on an average much shorter than in *riponi* and *nycthemerus*.

Colours of Soft Parts.—As in *nycthemerus*.

Measurements.—Wing from 9·7" (246·5 mm.) to 11·0" (279·4 mm.) with an average for twenty birds of 10·3" (261·6 mm.); tail from 16·0" (406·4 mm.) to 20·8" (528·3 mm.), nearly always below 19·0" (482·6 mm.); tarsus 3·45" (87·5 mm.) to 3·85" (97·7 mm.); bill at front about 1·2" (31·0 mm.), and from gape 1·4" (35·5 mm.); spurs nearly always under 1" (25·4 mm.), and crest from 2·7" (68·5 mm.) to 3·5" (88·9 mm.), and averaging under 3" (76·2 mm.).

Female.—General colour above rich olive brown, crest darker and tail very richly barred and mottled with deep chestnut and

blackish brown, the outer tail feathers darker than the central ones. Under parts rufous brown to rich blackish brown, the feathers marked with bold concentric bars of rich fulvous, these bars following the contour of the feathers, and not in longitudinal striæ as in *lineatus*.

Colours of the Soft Parts. As in *nycthemerus*.

Measurements.—Wing 9" (228.6 mm.) to 10.1" (256.5 mm.) with an average for twenty-one birds of 9.6" (243.8 mm.); tail from 9.2" (233.6 mm.) to 12.0" (304.8 mm.), with an average of about 10.8" (274.3 mm.); tarsus about 3.3" (83.8 mm.); bill at front about 1.1" (27.9 mm.) and from gape about 1.3" (33 mm.); crest about 2.0" (50.8 mm.).

In adult females there is generally an indication of a spur shown by a knob which sometimes protrudes from the tarsus as much as .15" (3.7 mm.).

Weights.—The average weight of the male is 3 lbs., and that of the female 2½ lbs. The above averages have been obtained by weighing some twenty specimens." (Nisbett.)

Distribution.—Roughly speaking, the range of this bird is bounded by the Irrawaddy and Salwin Rivers on the West and East respectively, on the North by latitude 27° and South by latitude 21°. It must, however, be remembered that *Gennæus horsfieldi horsfieldi* wanders down the Irrawaddy over the greater part of this area on the banks of the river and lowest hills, and that between the habitat of the two birds there is a no-man's land which is occupied not only by birds which are in a geographic (or climatic) transitional stage, but by a very great number of pheasants which are hybrids, the result of direct crossing between true *horsfieldi* and *n. rufipes*.

The article by Mr. Finn and Capt. Nisbett in this Journal XIII., p. 521, is of the greatest interest, and it is remarkable that this combination of acute observers should have got so much nearer the truth in regard to the subspecies and species of *Gennæus* than did Oates with nearly ten times the material to work on. Capt. Nisbett remarks:—

"The lower in altitude and the nearer the Irrawaddy one finds them, the more they partake of the Black-Breasted Kalij in character; and the higher one gets towards the Chinese frontier, the more they partake of the appearance of the Silver Pheasant."

Mr. Finn adds to this:

"There can be no doubt that the very interesting series of forms of *Gennæus* forwarded by Capt. Nisbett and described above, are hybrids of various grades between the common Black, or Black-Breasted Kalij (*Gennæus horsfieldi*) and

"Crawford's or Anderson's Silver Pheasant with which I unite
 "Mr. Oates' *G. rufipes* from the Ruby Mines."

Nidification.—Nothing recorded. I am told by my correspondents that March and April are the two principal breeding months for this Pheasant, though none of them have so far been successful in taking eggs or chicks.

"It is probable that they will be found to breed in the two months mentioned and in May as well.

General Habits.—Captain Nisbett writes as follows:—

"These birds are found at an altitude between 3,000 and 5,000 feet. They are generally found in parties of 3 to 7, though the males often wander about by themselves. They generally keep in the nullahs near the water during the heat of the day, and in the early mornings and towards evenings feed along the hillsides and on high ground, being especially fond of long flattish spurs or knolls covered with open evergreen forest. They are intensely shy, and one rarely has an opportunity of seeing them, as they make off very quickly on hearing anyone coming, and then rarely take to flight, unless run down by dogs, when they fly up into the trees. They are confirmed runners, and it is often hard to make them take flight even with dogs. Their food consists entirely of jungle seeds, insects and acorns. My usual way of obtaining them was to walk very quickly along a jungle path until I heard the sound of their scratching up the dry leaves in search of food. I would then send a cooli, who always accompanied me, to take a circuit in the jungle and get round them; and on his advancing towards them, they nearly always came within shot. This sounds like poaching, but it is the only way of getting them: shooting them in a fair way is impossible. On my first acquaintance with them, it took me over a fortnight to get a single specimen, though I met them every day.

"The breeding season begins about April, when the cocks can be heard challenging one another in the early morning. When breeding, they appear to leave their usual haunts in the open jungle, and disappear altogether, probably in the thick undergrowth. Since the end of April I have hardly come across a bird, though I constantly met them before.

"I have not been successful in obtaining any eggs, though I have asked Kachins to try and get me some."

All that can be added at present to the above is that after April the birds probably go into the still higher hills to breed, which would account for Capt. Nisbett never putting the birds up, and the Kachins failing to obtain eggs.

Genus—*PHASIANUS*.*True Pheasants.*

The True Pheasants form a genus of which the Common and Ringed Pheasants are well-known examples. The tail which is of 16 or 18 feathers, is longer than the wing in both sexes, and in the male often reaches a very great length; it is strongly graduated, the outermost pairs being frequently much shorter than the upper tail coverts. There is no crest, but usually two short thick tufts on either side of the crown behind the eye, which are, however, very small in some species. The males are brilliantly coloured with both ordinary and metallic colours, whilst the females are plain brown birds more or less mottled with varying amounts of buff, rufous, black and white.

The wings are rounded with a small first primary intermediate in length between the 7th and 10th and the tarsi and feet are strong and well-formed for running, and are furnished with a spur in the male which is rudimentary or absent in the female.

The space round the eye is bare in the males, and in some species is developed into wattles, in the female the eye area is feathered or bare in a less degree than in the male.

There are two species of true Pheasants found within our limits, *Phasianus humiae humiae* and *Phasianus elegans*, and a second subspecies of the former *P. h. burmannicus*. These birds have often been referred to the genus *Callophasis*, a genus created by Elliott for *Callophasis ellioti*.—I do not, however, see sufficient reason for dividing the two genera.

Elliott gave his reasons for dividing them as follows:—

(1) In the genus *Callophasis* as represented by *ellioti* the bare skin of the face never develops into the heavy wattles found in all males of true *Phasianus*.

(2) The feathers of the lower rump

“are rounded and proceed in regular rotation down the back
“and form an abrupt, distinct line just above the upper tail
“coverts, leaving them entirely exposed” . . . In all
“true pheasants these are long, loose, split and of a hairy-like
“texture, very dense and almost, if not entirely, conceal
“the upper tail coverts.”

(3) The spur is in shape and character nearer to *Gennæus* (*Euplocomus*) than to *Phasianus*.

Of the three reasons given (1) is only a matter of degree, (2) is to some extent a matter of degree, and (3) is not correct for the spur is actually much more like that of *Phasianus* than the *Galline* spur of *Gennæus*.

As regards the female, Elliott observes that it

“exhibits to an even greater degree than the male, characters
“not found in any species of Pheasant belonging to existing
“recognised genera” (? species) “and in her relation to
“him, differs in a more marked manner than is to be witnessed
“among the females of any of the species of the genus
“Phasianus.”

The characters to which he refers are (1) the naked space round the eye, (2) the comparatively short tail, and (3) the indication of a spur.

Here again, (1) is the only point which needs to be dwelt upon, (2) is entirely a matter of degree, and (3) is incorrect, for there is an indication of a spur in the females of nearly all the Pheasants, whilst actual spurs are by no means uncommon.

The differentiation between *Callophasis* and *Phasianus* rests therefore entirely on the supposed structural differences in the rump feathers of the male and the bare orbital skin of the female. Under these circumstances, as I have said above, I retain all the species under the one title of *Phasianus*.

KEY TO SPECIES AND SUBSPECIES.

- A. 16 tail feathers, cross bars on central tail feathers an inch or more apart. Crown green in males.
 - a. Rump steel blue and white in equal portions *P. h. humie*.
 - b. Rump black and white, the latter predominating *P. h. burmannicus*.
- B. 18 tail feathers, cross bars under one inch apart in both sexes *P. elegans*.

PHASIANUS HUMIE HUMIE (Hume).

Mrs. Hume's Pheasant.

Callophasis humie, Hume, Str. Feath., IX., p. 461 (1881); id, ibid, XI., p. 302 (1888).

Phasianus humie, Godwin-Aus. P. Z. S. (1881), p. 715, Pl. LI.; Ogilvie-Grant, Cat. Birds B. M., XXII., p. 335 (1893) (part); Blanford, Fauna B.I., IV., pp. 80, 486 (1893) (part); Finn., Jour. A. S. Beng. (2), LXVI., p. 523 (1897) (part); Finn and Turner, ibid, LXIX., p. 144 (1900); Venning, Jour. B. N. H. S., XXI., p. 392 (1912); J. P. Cook, ibid, XXII., p. 270 (1913); Mackenzie and Hopwood, ibid, XXV., p. 91 (1907).

Callophasis humie, Ogilvie-Grant, Monograph Game-B., II., p. 42 (1897) (part); Sharpe, Hand. B., I., p. 38 (1899); Finn, ibis (1898), p. 311 (part); Oates, Man. Game-B., I., p. 304 (1898). Finn, Indian Sporting-B., p. 201 (1915).

Vernacular Names.—*Yin* (Burmese), *Wuri* (Kachin); *Loe-nin-pi* (Manipuri).

Description—Adult Male.—Crown brown, tinged with olive, the feathers next the bill and over the eye next the bare orbital skin dark brown, faintly glossed with green, chin and upper throat black; neck, upper breast and upper back deep velvet-black with broad edges of deep steel blue, the black centres concealed, or merely shewing on the posterior parts as half hidden round spots; the blue of the upper back sometimes descends on to the centre back, almost to the lower back, and in all cases the change between the two colours is gradual, patches of metallic blue occurring even on the lower back; interscapulars and back with flame-coloured copper instead of green edges; lower back and rump steel blue, much paler in tint than the back, and each feather with white edges and a white bar bordered above and below with black; upper tail coverts grey, faintly vermiculated with white and with an obsolete broken black bar across the centre; tail similarly vermiculated grey with bars of black, more or less mottled with chestnut on the central pair of feathers, and with a broad sub-terminal bar on the four outer pairs, increasing in width towards the outermost; two or three pairs of these are also tipped with mottled white. Lesser wing coverts and median wing coverts like the back, the former with a broad band of white, narrowly edged with steel blue and with bases of glossy blue-black, and the latter with a broad bar of black glossed with the same steel blue as the rump; greater coverts deep chestnut, those next the quills with broad white edges and blue-black sub-edges, forming a third double bar across the closed wing; primaries brown, edged chestnut, secondaries entirely chestnut on the exposed portions except the innermost, which have white tips with a narrow sub-terminal bar of black. Lower breast like the upper back, gradually merging into deep bright chestnut on the flanks and abdomen; thighs and centre of abdomen about vent mottled brown and chestnut; under tail coverts black with a faint blue-green gloss.

"Male.—Length 33·0 inches; expanse 26·0; tail (of sixteen feathers) from vent 21; wing 8·6; tarsus 2·75; bill "from gape 1·8. Weight 2 lbs. 6 ozs. The legs, feet, claws "and spurs (the latter 0·85 length) all a pale delicate drab "brown; the facial skin an intense crimson; irides orange; "bill greenish horny, dusky on cere and base of upper mandible, and pale yellowish horny towards the tip of both "mandibles." (Hume.)

Measurements.—The small series I have been able to examine or obtain measurements of, *viz.*, 6 in the British Museum, 2 at Tring, and 3 in the Museum of the Natural History Society of Bombay, have measurements as follows:—Wing from 8·1" (205·7 mm.) to 8·8" (223·5 mm.); tail from 15·8" (401·3 mm.) (a bird in very poor condition) to 21·5" (534·6 mm.); tarsus 2·3" (58·4 mm.) to 2·6" (66·0 mm.); bill at front about 1·1" (27·9 mm.), and from

gape about 1·3" (33·0 mm.); spur from ·33" (8·3 mm.) to ·7" (17·7 mm.), generally under the half inch (12·7 mm.). The average length of wing is 8·5" (215·0 mm.).

Young Males.—In otherwise fully adult plumage, have the wing quills mottled brown and dull chestnut, but *not barred* like the females.

Adult Female.—Upper parts of the head reddish brown, the feathers of the crown with more or less well-defined black centres; sides of the head, lores, ear coverts and chin dull fulvous, sparsely spotted posteriorly with black; neck sandy brown above obsoletely barred with blackish and more boldly so on the sides; upper back and scapulars the same, but with bold velvety black edges and bars and white arrow-shaped mark in the centre of each feather; lower back rump and upper tail coverts mottled sandy-brown and black with indefinite black centres to the feathers, more pronounced on the rump where there are also some white marks, and on the upper tail coverts. Central tail feathers like the tail coverts with ill-defined mottled bars of dark brown; outer tail feathers chestnut with black bars and broad white tips. Below, the breast is pale sandy or greyish brown with a few black spots; lower breast, flanks and greater thigh coverts sandy rufous, barred with very pale grey; thigh coverts a darker sandy brown, and the vent and centre of the abdomen duller and paler than the flanks; under tail coverts mottled brown, white and sandy, the longest chestnut with black, bars and broad white tips. Visible plumage of the wings mottled grey, brown and sandy rufous with bold markings of black, and with whitish edges to the median and greater coverts, which form narrow and faint white bars across the wing; primaries brown, mottled with rufous and with broad pale buff bars on the outer webs.

Measurements.—The only female I have been able to measure has a wing of 7·8" (198·1 mm.); tail 7·5" (190·5 mm.), and tarsus of 2·4" (60·9 mm.); the bill at front is about 1·0" (25·4 mm.), and from the gape 1·2" (30·5 mm.). It should be noted that Godwin-Austen gives the length of his specimen's wing in the flesh as 8·25", and the tail as 7·0" only.

Colour of Soft Parts.—The only note I can find on this point is in Godwin-Austen's description, in which he says:

"A reddish patch surrounding the eye."

Distribution.—Up to very recently all that was known of this bird's habitat was given in Godwin-Austen's description in *Stray Feathers*, and Godwin-Austen's in the *Bombay Natural History Society's Proceedings*.

The former recorded it as being found in the Kamhow district of South Manipur, in the North-West Independent Burma, while the latter recorded specimens, as had Dr. Watts, in East Manipur close to the Nagas Hills.

Latterly they have been repeatedly shot on the Chin Hills as far South as Falam and Fort White, whilst Venning reports them as not uncommon still further South at Haka, where he saw flocks of as many as ten birds together. Again East and North-East of Manipur on the hills bordering the Chindwin and Oyu Rivers, it has been seen and shot, and it certainly extends as far North-East as the Patkoi Hills, as I have seen its feathers on the baskets of the Nagas from this district. At present there is nothing to show what is the boundary between *humie* and *burmannicus*, and this may prove to be either the Chindwin or the Irrawaddy, as, so far, no birds of this genus have been found in the inter-land of these two rivers. Probably, however, considering the distribution of *humie* in the N. E. Naga and Patkoi Hills, the latter river will be found to be the Western limits of *P. h. burmannicus*.

Nidification.—As far as I know, the only collectors who have hitherto succeeded in finding the nest and eggs of this most beautiful bird are Messrs. Wickham, Hopwood and Mackenzie, to whom I am indebted for specimens of the eggs and many valuable notes.

The two latter gentlemen, when touring in the North Chin Hills, had a clutch of 8 eggs brought in to them in the end of April 1914 by the Chins, said to be those of Mrs. Hume's Pheasant; unfortunately they were on the verge of hatching, and it was only possible to save 4 eggs out of the clutch. The eggs were, however, not such as had been expected, so that it was with the greatest delight the same two collectors had the good luck to themselves to take a second nest and see the parent bird within a few days of receiving the first. This nest, which was found on the 1st of May, contained only 7 eggs.

In the following year, near the same spot and on the same date, Mr. Mackenzie obtained another nest with 10 eggs, whilst on the 20th April and the 1st May two other clutches were brought to him by Chins, containing respectively 6 and 7 eggs. In neither of these two instances were the parent birds trapped, though the Chins produced some feathers to support their story; the eggs are, however, exactly similar to those taken personally by Mr. Mackenzie, and there does not seem to be any reason to doubt their authenticity.

All these eggs were taken from a ridge above and to the West of Haingyan, near Hankin, at an elevation of some 7,000 feet.

Mr. Mackenzie (*in loc. cit.*) gives a brief note on the breeding of the Pheasant, but unfortunately tells us nothing about the nest or where it is placed. He writes:

"Eggs, with a bird skin. The eggs were of the ordinary '*Phasianus* type: three clutches were obtained, all from about '6,500'. The bird seems to breed near the top of the main ridge."

The eggs are certainly not in the least like what I should have expected, being far more like small, fragile eggs of the Jungle-Fowl than those of the True Pheasants. At the same time, even if Mr. Mackenzie had not, as he informs me in a letter, on the one occasion seen the bird leave the nest, it would have been difficult to attribute them to any other bird than Mrs. Hume's Pheasant. The Jungle-Fowl does not breed at 7,000 feet in this part of Burmah, and the eggs are *much* too small for any of the forms of Silver or Kalij Pheasants which are to be found in the Chin Hills and, moreover, though superficially just like Jungle-Fowls' eggs, those I have seen are more finely grained, with a closer texture, slightly glossed, and with much thinner shells in proportion to their size.

Eggs very similar to those in my collection—which I owe to the generosity of the above-named gentleman—are four eggs laid by *P. elegans* in the Zoological Society's Gardens in Regent's Park, and which are now in the Natural History Museum. Both *Phasianus*, *scintillans* and *P. ellioti* also lay cream or stone-coloured eggs, so that there is really nothing extraordinary in Mrs. Hume's bird doing the same.

In shape they are broad ovals, but little compressed towards the smaller end, and do not appear to vary much, but one egg in Mr. Mackenzie's series is a comparatively long oval measuring 1.99" × 1.31" (50.5 × 33.2 mm.).

In length the 30 eggs of which I have measurements vary between 1.78" and 2.03" (45.2 and 52.8 mm.), and in breadth between 1.31" and 1.48" (33.2 and 37.6 mm.), the average of the same number being 1.88" × 1.39" (47.7 × 35.3 mm.).

These Pheasants would appear to be early breeders, for both the clutches obtained in the end of April were so hard set that they must have been laid in March, and, though it is hardly safe to generalise on such scanty material, the 15th March to the 15th May is probably the limit of their breeding season.

General Habits.—This beautiful Pheasant, according to reports made to Hume by his Kamhow collectors, is found

"In dense hill forests at elevations of from 2,500 feet (the height of the lower end of the Manipur Plain, or, as it is called, valley) to fully 5,000 feet. They prefer the neighbourhood of streams, and are neither rare nor shy."

This description of their habitat is probably not correct. For fifteen years I lived in the North Cachar Hills next to Manipur, and yearly visited the Jainti Valley, and worked it and the adjoining hills most exhaustively up to 5,000 and 6,000 feet, but never saw or heard of this bird being found there. All my Manipuri collectors, also, assured me that the bird was not found until one got into the far higher country arising from the Naga Hills round the far North and East of the Manipur Plain at elevations from 4,000 feet

or more up to 9,000 or 10,000. The lowest point at which Godwin-Austen got it was on the Shiroifura peaks at between 7,000 and 9,000 feet; in the Eastern Chin Hills it is found between 4,000 and 7,000 feet, and at Haka at about 4,000 feet and upwards, whilst in the extreme North of the Chin Hills it is found from 6,000 to 9,000 feet.

It may, of course, wander down sometimes as low as 2,500 feet in the coldest part of the cold weather, but I think such occasions must be of the rarest.

Again it does not appear to be a denizen of the dense, tropical and more or less evergreen forests of the hills of the lower elevations, but to haunt the more open oak, pine and other forests and grass lands which are to be found from 4,000 feet upwards. Mr. J. P. Cook found it frequenting heavy patches of grass and dwarf date palm in more or less open grass land mixed with patches of forest and found that they had been feeding on acorns. Again, near Fort White one of my correspondents informs me that he always obtained these pheasants

"in forest growing on very rocky, broken hillsides, where the undergrowth was light, except for open patches of bracken and grass, and the trees, for the most part, stunted and growing well apart from one another. If not in this kind of forest, they were to be found in the open grass-land, feeding in the more open land, and lying up during the hotter hours in the denser patches."

Finn, who was the first writer to draw attention to the difference between Mrs. Hume's Barred-Back Pheasant and the Eastern Burmese form, quotes at some length an interesting letter from a Mr. Turner.

"I had left my camp, which was pitched some six miles from Fort White, on the evening of 6th March, to go after some Hill Partridges, which one of my men had seen just below my camp; not seeing any signs of them, I walked on for about a mile, and was returning along the road (the Fort White-Kalemyo Road) when, glancing down the *khud*, I saw something grey disappearing in the long grass just below me. I immediately started to go after it, when I saw what appeared to me to be a light blue streak just disappearing. I immediately fired, but it was with faint hope I walked up to the spot, as not only did I think the bird had disappeared before I shot, but I had just at the moment of shooting, slipped. I was therefore very much delighted when I saw the blue streak tumbling down the *khud* below me. I immediately went after and secured him; as I was descending the original grey bird, which was evidently the female, got up and flew a short distance. I walked her up,

"and my dog again put her up; unfortunately, owing to the thick jungle, I was unable to get a shot. Walking on, however, I again put up another, whether a cock or hen, I could not say, as it was already dark. I fired, but the bird flew away, and although I believe it dropped, I could not find it. These birds, when I saw them, were feeding amongst the dead leaves which littered the ground.

"The next evening I tried the upper side of the road, and put several (four at least) of the same birds out of the long grass on a steep hillside. I only managed to get one long shot which was not successful. I again tried the next morning, and was successful in bagging another; my dog put it up on our right, and flying very low through the bushes, it crossed just in front of me. Unfortunately, the bird was not well skinned, and I had to throw it away.

"The specimen that I have retained is a full-grown cock; the other one was a young cock without the long tail, the plumage was otherwise identical with that of the other bird. The hill on which I obtained these specimens was between 4,000 and 5,000 feet high, being one of the spurs of the Chin Hills running down into the Kale Valley, and the birds were close to the Fort-Kalembo Fort White Road, just about at milestone 20. The latitude is approximately 23° and the longitude approximately 96° ."

Mr. Cook in a letter to me writes:

"*P. humiae* I often saw and shot. The birds were generally to be found in somewhat open jungle, where the trees are principally oaks and similar species, and where one finds an undergrowth and open spaces of long grass, or long grass and bracken mixed. Near Minkin I found them in steep grass slopes, and here they were by no means uncommon, and associated in small flocks or family parties. On one occasion I flushed no less than eight or ten birds from an ant-hill overgrown with grass and crowned with a clump of dwarf dates, upon the fruit of which I think the Pheasants were feeding. On another occasion I saw a couple of hens with a cock at Pine-Tree Camp in similar jungle and at about the same elevation (7,000 feet).

"As far as my experience goes they do not fly very far when first flushed, and as a rule they fly low down, seldom, if ever, rising above the tops of the trees; nor does their flight strike one as being at all fast, and, indeed, compared with the English Pheasant, it seems very much slower. They are not hard birds to flush, especially the first time, but as I have nearly always had a dog out with me when

"after these birds, I cannot speak with much authority on this point. When alighting after the first flight, they often run considerable distances, but at others one may put a bird up time after time from almost the exact spot at which he drops.

"They are such beautiful birds that their very beauty has sometimes saved their lives when I have really wanted them very badly; their skins as specimens and their flesh for the pot. To see half a dozen cock birds rise almost at one's feet and then scatter in all directions, the wonderful blue and white feathers of their rumps shewing up like flags against the rest of the brilliant plumage, is a most extraordinary sight, and I have found the blaze of colour so gorgeous and attractive that I have sometimes been arrested in the very act of raising my gun to fire, and have instead stood to watch them and enjoy the sight.

"I think wherever I have found this bird there have been outcrops of rock here and there in the grass they frequent. In some cases these outcrops are scattered and few, but in some cases very thick and plentiful, so that the patches of grass form little roads in between them.

"The only sound I have heard them make, and which I can with certainty attribute to them is a low grunting call, exactly the same as that made by *Phasianus burmannicus*, a bird I knew well in the South-East of these Hills."

The discovery of this beautiful Pheasant by Hume in 79 was always considered by him to be one of the, if not the, most important and interesting of his numerous discoveries. His attention in the first place was drawn to some feathers in the head-dress of a Manipuri Official sent to assist him in getting about in Manipur, which he at once saw belonged to a Pheasant unknown to him. These he was told were feathers from a bird called Loe-nin-Koi which occurred in the extreme South of the Manipur territory and in the Eastern Lushai country. It was weeks, however, before he succeeded in going with a small force of Manipuris into the Kamhow district, and even then it was only with the greatest difficulty that some Kamhow refugees were induced by a mixture of threats and promises to secure for him two specimens, one of which was alive.

Of the living specimen Hume wrote:

"The live bird, though a full-grown cock, became perfectly tame in a few days, and a great favourite in the camp. It would eat bread, boiled rice, winged white-ants, moths, taking them gingerly out of our hands."

Unfortunately this bird was eventually killed in a fire, so never reached its destination, the London Zoological Gardens.

PHASIANUS HUMILÆ BURMANNICUS (Oates).

The Burmese Barred-Back Pheasant.

Calophasis burmannicus, Oates, Ibis, 1898, p. 124; Sharpe, Hand-List, B., IV., p. 38 (1899); Finn, Ibis, 1898, p. 311 (part); Harington, Jour. B.N.H.S., XX., p. 1010 (1911); Oates, Man. Game-B., I., p. 308 (1898); Finn, In. Sporting B., p. 301 (1915).

Phasianus humilæ, W. L. Sclater (nec Hume), Ibis, 1891, p. 152 (part); Oates, Jour. B.N.H.S., X., p. 112 (1895); Ogilvie-Grant, Cat. B. B. M., XXII., p. 335 (1898) (part); id, Mon. Game B., II., p. 42 (1897) (part). Blanford, Faun. B. I., IV., pp. 80, 486 (1898) (part); Finn, Jour. A. S. B. (2), LXVI., p. 523 (1897) (part); id, ibid (2), LXIX., p. 144 (1900); Cook, Jour. B. N. H. S., XXI., p. 632 (1912); id, ibid, XXII., p. 270 (1913).

Vernacular Names.—Yit (*Burmese*), Wuri (*Kachin*).

Description.—*Adult Male*.—Similar to *P. humilæ humilæ*, but with the steel blue of the upper parts confined to the extreme upper back, and much more sharply defined from the copper-coloured mantle; the rump is black and white instead of blue and white, and even when there is a certain amount of blue gloss, as is sometimes the case, this is of a deeper tint than it is in Mrs. Hume's Pheasant; the white fringes are also broader and more dominant than they are in that bird.

The colour of the tail bars, given by Oates as one of the distinguishing features, is not of much use. Generally there is more chestnut on those of *P. h. burmannicus*, but this is not invariably so, and in some birds there is no more than in the type of *humilæ*. Again, Oates' definition of the differences in the colour of the bases to the feathers of the lower white wing bar does not hold good. He says that in *humilæ* the concealed bases to these feathers are black, whereas in *burmannicus* they are "chestnut with a firm black bar." This is practically correct as far as the types of the two subspecies are concerned, though the bases of the innermost feathers are well-marked with chestnut in the wing of *humilæ*, but in other specimens this difference is not maintained.

In *burmannicus* the central black wing-bar is often mixed with maroon or copper colour, but this is not always so, and in one specimen in the British Museum series this black wing-bar is broader than in any specimen of *humilæ*, and is equally free from all admixture of maroon.

Measurements and Colours of Soft Parts.—The same as in *humilæ*. In the series of 16 males in the British Museum and at Tring the wing varies between 8.5" (215 mm.) and 9.3" (236.2 mm.), with an average of 8.85" (224.9 mm.); the tails run up to 26.5" (673.1 mm.), and average about 22" (554.8 mm.), tarsus, spur and bill measure within the extremes given for *humilæ*.

Adult Female.—Similar to that of *humie*.

Measurements.—Wing from 7·7" (195·8 mm.) to 8·3" (210·8 mm.); tail 7·7" (195·8 mm.) to 8·6" (218·4 mm.); tarsus about 2·4" (61·0 mm.), bill at front about 1" (25·4 mm.) and gape 1·2" (30·5 mm.).

Distribution.—Yunnan, Northern Shan States, and the greater part of the Southern Shan States. To the West it appears nowhere to cross the Irrawaddy, which River probably forms the dividing barrier between this and Mrs. Hume's Pheasant. To the East we do not yet know for certain how far it extends, but up to now there is no record of its having been seen or obtained East of the Salwin River. I have records of its having been obtained at Myitkyna, Sadon, N. E. of Nilamka, Mogok, Maymyo, Kalaw, Taungyi, Fort Stedman, and Loimai. South of this again, North of the Bree country, a Pheasant has been seen which will assuredly prove to be of this species, and almost equally certainly of the present subspecies, but no specimen has been actually secured.

Nidification.—There is at present absolutely nothing on record about the breeding of this beautiful Pheasant, but, with the care and industry with which our field-ornithologists are now working Burmah, the finding of the nests and eggs cannot be long delayed.

General Habits.—Like its cousin, Mrs. Hume's Pheasant, the Burmese Barred-Back Pheasant frequents the mountainous regions of Eastern Burmah between 4,000 and 9,000 feet, keeping more to the open than to the very heavy forests, though even in the former there are always pockets and ravines which have the trees and undergrowth very dense and tangled. It is also found on grass-covered hill-sides, well away from any large tree forest, and seems to keep together in small flocks, probably composed of the cock and hen and the last hatched brood.

Mr. J. P. Cook writes in the Bombay Journal of this Pheasant:

"I saw this beautiful bird, or it may have been *P. burmannicus* '1331a' (this it proved to be) 'several times, and generally in the open jungle on rocky grass-hills. On one occasion I put up five birds singly at intervals of about a minute or two. At one time I thought I had found a nest, as a hen bird rose at my feet, but I hunted everywhere without success. These Pheasants do not seem to be quite so gregarious as *G. lineatus*, nor so partial to the proximity of water. I should like to have shot one or two, but when I saw them I always had my little .410 with me only, which would not have been sufficient to have brought them down. On one occasion I put up a Pheasant out of some wild raspberry bushes amongst long grass, the fruit of which it was perhaps feeding on."

PHASIANUS ELEGANS (Elliot).

Stone's Pheasant.

Phasianus elegans, Elliott, Ann. and Mag. N. H. (4), VI., p. 312 (1870); Sclater, P.Z.S., 1870, p. 670; Elliott, Monog. Phas., II., Pl. VIII (1872); Ogilvie-Grant, Cat. Birds B.M., XXII., p. 329 (1893); id Hand-L. Game-B., II., p. 31 (1897); Blanford Faun. Brit. Ind. Birds, IV., p. 81 (1898); Oates, Man. Game-B., I., p. 299 (1898); Styan, Ibis, 1899, p. 298; Davies, Ibis, 1901, p. 408; Buturlin, Ibis, 1904, p. 411, id Ibis, 1908, pp. 574, 576, 585, 592; Harington, Jour. B. N. H. Soc., XIX., p. 309 (1909); Sclater Ibis, 1912, p. 554; Ingram, Novit. Zool., XIX., p. 271 (1912); Bailey, Geog. Journal, XXXIX., p. 346 (1912); id Jour. B. N. H. Soc., XXII., p. 367 (1913); Bangs and Phillips, Bull. Mus. Comp. Zool., LVIII., No. 6, p. 269 (1914).

Phasianus sladeni (Anderson MSS.) Elliott, P.Z.S., 1870, pp. 404, 408; Anderson, P.Z.S., 1871, p. 214; Swinhoe, P.Z.S., 1871, p. 378; David and Oustalet, Ois. Chine, p. 411 (1877); Anderson, B.W. Yunnan Exp., p. 671, Pl. II. (1878).

? *Phasianus sichuanensis*, Bianchi, Bull. Acad. St. Petersb., V. Ser. T., XXIV., n. 1-2, p. 83 (1906); Buturlin, Ibis, 1908, p. 574.

Vernacular Names.—? Wucru (*Kachin*), Tso-ka (*Tibetan*).

Description.—*Adult Male*.—Crown from forehead to nape and hind neck bronze-green, the ear tufts darker and more blue; chin and throat deep green; neck in front and on the sides deep purple blue with purple copper reflections in some lights, this colour passing round the base of the neck as a collar behind; upper back golden chestnut, changing into deep chestnut on the back and scapulars; the feathers next the neck are centred with black and their tips are notched with the same; the feathers of the back and the scapulars have black centres mottled and sub-out-lined with buff, and the same notches as on the upper back, but the black obsolete. Lower back, rump and tail coverts pale green-grey with sub-terminal bars of lustrous emerald green, and each feather with the concealed base black with buff concentric bands. Tail feathers rufous brown with broad black bars, narrowly edged above and below with golden buff; the central pair have wide margins of pink-grey, across which the black bands are continued as dull crimson purple marks; on each succeeding pair the pink edges are reduced in size, and are absent on the outermost pair, and sometimes on one or two of the next pairs also.

Wing-coverts pale green grey with emerald green reflections, and with the innermost greater coverts splashed with maroon, broadly on the outer and narrowly on the inner webs; quills brown, the primaries barred with buff on the outer webs and with broken bars on the inner; secondaries broadly edged with olive brown and irregularly marked with buff on both webs.

Below, breast deep glossy green, each feather narrowly margined with velvety black, and those on the lower breast notched, though less conspicuously so than on the back; flanks and sides of the breast purple copper, becoming almost purple copper next the green of the

breast, each feather with a bold edging of velvet black, which runs down the end of the shaft towards the greenish base, vent, thighs, and centre of abdomen dull brown; under tail coverts chestnut with black marks.

Colours of the Soft Parts.

"Legs and feet of the male lead colour, inclining to flesh colour; naked skin around the eye scarlet." (Elliot.)

Measurements.—Wing 8·3" (210·8 mm.) to 9·0" (228·6 mm.), with an average for 20 males of 8·6" (218·4 mm.); tail 15·4" (391·1 mm.) to 19·2" (487·6 mm.), generally between 17" (432 mm.) and 18" (457 mm.); bill from front about 1·2" (30·4 mm.), and from gape about 1·4" (35·5 mm.); tarsus 2·5" (63·5 mm.) to 2·7" (68·5 mm.); spur about 4" (10·1 mm.).

Adult Female.—Crown and neck dark brown or black with narrow bars of buff, sometimes with a distinct tinge of chestnut; back and scapulars chestnut with white sub-edging, and very fine edges of black and a bold bar of the same between the chestnut and the white; remainder of upper plumage pale grey brown with narrow buff edges and black centres with here and there a tinge of chestnut shewing very irregularly. Central tail feathers pale olive brown with narrow paler cross bars broadly margined on either side with black; remaining tail feathers dull chestnut with similar bars; in all the tail feathers the markings are irregular, and somewhat mottled, giving a mottled appearance to the whole.

Below, the chin and throat are pale buffish, obsoletely barred with dark brown; foreneck and upper breast with bolder bars of black and black centres and washed with a pinky reddish tinge, lower breast, flanks and abdomen dull greyish buff with numerous faint vermiculations of grey-brown, and with visible centres of deep chestnut brown; under tail coverts the same marked with chestnut.

Three females from Chang Youn, in China, are more richly coloured above than any of the more Western birds, but, at the same time, have practically no dark markings on the lower breast and abdomen; the flanks and thigh coverts are, however, fully as boldly marked as the other birds.

Colours of Soft Parts—not recorded.

Measurements.—Wing 7·8" (198·1 mm.) to 8·2" (208·3 mm.); tail from 9·7" (246·4 mm.) to 10·7" (271·8 mm.); tarsus 2·4" (60·9 mm.) to 2·6" (66·0 mm.); bill at front about 1·1" (27·9 mm.), and from gape about 1·3" (33·0 mm.).

Distribution.—Western Szechuan, Eastern Tibet, at least as far West as Batang, Yunnan and the Northern Shan States and Kachin Hills and Southern Shan States.

As regards Tibet, Bailey says:

"I shot a specimen of this on the Fei-Yueh-Ling Pass, South-East of Ta-chien-lu. It was plentiful at Ta-chien-lu itself, and

"a few were seen in suitable places up to Batang again in Yangtse Valley, two days South of Batang and near the Kia-la."

Harington obtained a male at Ta-shio-tang, Tawnio State, Trans-Salwin; Major J. Whitehead got another male at Namsang-yang between Talawgyi and Lawchen, and a third was also obtained by Captain Bard in the same district close to Myitkina.

It is apparently found as far South in S. Shan States as 21°.

Nidification.—I can find nothing on record concerning the breeding of this Pheasant in a state of a nature.

I have two eggs in my collection which I owe to the generosity of Mr. Charles M. Inglis. They were laid by the hen of a pair kept by him in an aviary in Tirhoot, and are two of a clutch of 7.

In appearance they are typical Pheasants' eggs, exactly like many laid by *torquatus* and *colchicus*, in English woods and spinneys, and not like the *Gennæus* type of egg laid by *Phasianus humia*.

In colour they are a clear, deep fawn-brown, and in shape typical pheasants' eggs, though not of the extreme peg-top shape. The surface is very smooth and fine grained, and has a slight gloss. They are rather fragile eggs for their size, considerably thinner than the shells of eggs of the Silver Pheasants.

The two eggs measure respectively 1.75" (44.4 mm.) × 1.35" (34.3 mm.) and 1.75" (44.4 mm.) × 1.34" (34.0 mm.).

General Habits.—Elliot records of the two specimens of this bird first brought home to England and deposited in the Gardens of the Zoological Society that they were very wild, and endeavoured to hide from anyone who approached their cage. He also says that:

"The voice of *P. elegans* is harsh and guttural, very different from that of any of its relatives."

On the other hand Harington says that its call is exactly like that of the English Pheasants.

Capt. Davies agrees with the latter, he writes:

"Stone's Pheasants are common in Western Yunnan. They are not usually found much below 4,000 feet, and are most plentiful near the tops of the ranges at an altitude of from 6,000 to 8,000 feet, in long grass and fern, or in fir woods. I have usually met with them singly or two together, but on one occasion I saw a covey of ten. The crow of this bird is hardly distinguishable from that of the English Pheasant, and the noise the cock makes when flushed is also the same. I have not often seen it in the Tibetan part of the country. (W. Szechuan) though I shot one a few marches South-West of Li-tang at 10,500 feet."

Harington never succeeded in getting a second specimen, though he often heard them crowing. Those he came across were all on the almost bare hillsides covered merely with dry weeds and grass about four feet high, but with no trees or bushes.

(To be continued.)

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XVII.

(A).—THE SHAN STATES LANGUR.—A CORRECTION.

BY

R. C. WROUGHTON.

In the last number of this Journal (p. 46) I described a series of langurs obtained by our Survey in the Shan States. I took (and gave) much trouble, in making sure that the species could not be *barbei*, Blyth, and concluded to give it the name *shanicus*. I regret to say that I completely overlooked a specimen in the British Museum Collection, obtained at Bhamo, by Fea, which Dr. Elliot made the type of his species *melamerus*, (A. M. N. H. S. 8, p. 267, 1909). This cannot be distinguished in any way from *shanicus*. The Shan States langur must, therefore, be known as *P. melamerus*, Elliot, with *P. shanicus*, as a synonym.

(B).—A NEW INDIAN HARE.

BY

R. C. WROUGHTON.

In connection with a summary of the results from our Mammal Survey, I have recently had to re-examine all the hares in the British Museum Collection. Among them I have found a series sufficiently distinct from the rest to deserve a name of its own.

It consists of four specimens, taken near the Sambhar Lake, in Rajputana, more than thirty years ago. These are allied by their brown-coloured scuts to *ruficaudatus*, Geoff., but their general coloration is so markedly and evenly like that of so many animals inhabiting sandy wastes, and at the same time so distinct from the coloration of all their neighbours, that it seems to me that I am justified in giving them a name. I propose to call them

LEPUS RAJPUT, sp. n.

A hare about the size of *ruficaudatus*, Geoff., or *simeoni*, Wr., but differing from both by its bright buff colouring.

General colour above "tawny olive." The individual hairs of the lower back are white at their bases (8mm.) and thereafter a band of buff (12mm.) between a black band and a black tip (each 3-5mm.). Tail coloured like the back above, white below. Face and ears coloured quite like the back, but with the usual white blaze through the eyes. The nape and limbs ochraceous. The chin and belly pure white merging gradually into the buffy flanks.

Dimensions of the type.—Hindfoot, 103mm.; ear 105mm. (The dimensions of another very similar specimen are recorded by the Collector as follows:—head and body, 462mm.; tail, 112mm.; hindfoot, 107mm.; ear, 130mm.). Skull.—condylo-basal length, 78; zygomatic breadth, 42; greatest length of nasals, 41; posterior breadth of nasals, 21; breadth of nasals anteriorly, 16; palatal foramina, 21; diastema, 24; upper molar series, 15.

Habitat.—Rajputana. (Type from Sambhar Lake).

Type.—Adult male. B. M. No. 85, S. 1. 342. Collected by Mr. R. M. Adam and presented to the National Collection by the late Mr. A. O. Hume, I.C.S.

There seems to be no connection between *rajput* and either *dayanus* or *sincoxi*; in the coloration of its nape and scut it resembles *ruficaudatus*, of which it is possibly a desert form. The question of the exact status of the various named Indian hares is a most complex and difficult one, and I propose, for the present, to treat them all as species. Mr. Adam took three specimens of *rajput* near the Sambhar Lake, and Blanford a fourth in Alwar.

THE NOMENCLATURE OF THE GEOGRAPHICAL
FORMS OF THE PANOLIA DEER (*RUCERVUS*
ELDI AND ITS RELATIVES).

BY

OLDFIELD THOMAS.

Owing to the somewhat piecemeal way in which the Sangnai or Manipur Deer, commonly confused with the Thamin, was discovered, and the divided authority for its early description, a good deal of error has arisen as to the nomenclature of this Deer and its relatives, such as the giving and later withdrawal of the name *cornipes* by Lydekker.

And I now find that in the latter's latest work* certain essential points in the history of the animal have been overlooked, so that its nomenclature is still far from correct.

Recognizing *Rucervus* as a full genus, and raising to specific rank the three forms admitted by Lydekker, we may for the sake of clearness define them as:—

A.—With naked pasterns. Manipur ("*frontalis*" of Lydekker).

B.—With hairy pasterns; the horns not palmated. Pegu, Burma, &c. ("*eldi*").

C.—With hairy pasterns; the horns more or less palmated terminally. Siam and Hainan ("*platyceros*").

But if the nomenclature of each species is carefully investigated it appears that all the existing names applied to these animals (except *platyceros* and *siamensis*) were given to specimens originally from Manipur, as will be seen by the following synonymy:—

Nondescript species of Deer, McClell. Calc. Journ. N. H., I, p. 501, 1841, Manipur.

Cervus eldi, Editor (McClelland) Calc. Journ. N. H., II, p. 417, 1842. (Published at the suggestion of a correspondent, in a note to Lieut. Eld's account and drawings of the Manipur "Sungraë").

Cervus (Rusa) frontalis, McClelland Calc. Journ. N. H., III, p. 401, 1843. (Based on Capt. Guthrie's specimens from Manipur).

Panolia acuticornis, Gray. List Mamm. B. M., p. 180, 1843. (Based on the account and figure in the Calcutta Journal, 1842, in which the name *C. eldi* was only incidentally mentioned in a note. Locality therefore Manipur).

Cervus lyratus, Schinz, Syn. Mamm., II, p. 395, 1845. (Based on McClelland's "Nondescript species of Deer" 1841), (Manipur).

* Cat. Ung. B. M. IV, p. 100, 1915.

Panolia acuticauda, Blyth. P. Z. S. 1863, p. 370. (*Lapsus calami* for *acuticornis*).

Cervus eldi cornipes, Lyd. Nature LXIV, p. 257, 1901. (Based on a head and foot from Manipur, presented by Major C. S. Cumberland; B. M. No. 1. 7. 13. 1).

The whole of these names without exception refer to the Manipur stag, and to that alone. Consequently it is A, and not B, which should bear the name *eldi*, while *frontalis*, *acuticornis*, and the other names referred to are synonyms of it. For this animal also we may adopt the Vernacular name Sangnai and so avoid the term Thamin, which belongs exclusively to the next species.

The peculiarly modified naked pasterns of the Sangnai form a special character far greater in systematic value than anything that would be used merely to distinguish a subspecies.

For B, the Pegu Thamin, unspotted brown in the adult, with hairy pasterns and non-palmated horns, there appears to be no name available, and I would suggest that it be called *Rucervus thamin*. The adult male mounted in the Museum, from Pegu, presented in 1900 by Major (now Colonel) G. H. Evans, No. 0. 7. 23. 1 might be selected as the type. Col. Evans has given a good account of the animal in our Journal* and now tells me that the type was shot at Mohaingyi Escape, about 20 miles north of Pegu Town.

With regard to C, the palmated-horned Siamese and Hainan form, our knowledge is very imperfect. But the close similarity between the type horn (B. M. 695. h.), Schomburgk's fine skull No. 65. 11. 2. 1, and the highly characteristic horns from Annam collected by Dr. Vassal (8.11.1.18.) shows that the animal is sufficiently distinct to have a name. This, if *Rucervus* is recognized as a genus, should be *platyceros*, for Gray's *Panolia platyceros* is then not invalidated by Cuvier's *Cervus platyceros*, as Lydekker took to be the case.

Whether the Western Siamese form is *platyceros* or *thamin* remains to be proved, and it is possible that the two will be found to grade into each other, but I think it most convenient now to use a synonym for the comparatively well-known Burmese animal.

With regard to the Hainan representative of *R. platyceros* I am inclined to believe it forms a distinct local subspecies, which may be termed

Rucervus platyceros hainanus, subsp. n.

Horns smaller and weaker than those of true *platyceros* of corresponding ages. Stage at the junction of the brow-antler and the beam almost or entirely absent, these being large and conspicuous, often three in number on true *platyceros*.

Hab.—Hainan.

Type.—Frontlet and horns, said to be of a five-year-old male; figured by Swinhoe, P.Z.S., 1869, p. 655, fig. 2; B.M. No. 70. 2.10.72. Ost. Cat. 695. q.

The older horns also figured by Swinhoe on the same page are unfortunately no longer in the Museum, but the drawing shows the very slight development of the basal snags, in marked contrast to their number and size in old horns of true *platyceros*. And if they are drawn to anything like the same scale as the others, they must have been very much smaller than old *platyceros* horns.

All the references to Formosa in relation to the Museum specimens of this Deer should be deleted from Lydekker's Ungulates and be replaced by Hainan. The error seems originally to have been made by Gray or Gerrard.

With regard to the distinction of the different forms of these Deer by the antlers, it may be said in a general way that the horns of the Sangnai (*R. eldi*) are long, thin, and rather smooth, without or with but small and few extra basal snags at the junction of the beam and the long brow-tine. In the Thamin (*R. thamin*) on the other hand, the horns are comparatively rough, and basal snags are always present, commonly 3-6 inches long, and in one fine pair of horns from Thatone (Hume Coll.) the extra snags on each side are no less than 11 and 8 inches in length. And in addition more than one snag may be present on a single antler.

Similarly in the more Eastern group the horns of *platyceros* are greatly roughened and may have from 2-5 basal snags on each horn, these occasionally attaining a length of 5 inches. Even a young pair of antlers (Coll. Sir R. Schomburgk) has three distinct "buttons" on each horn, one behind the others. In *hainanus* on the contrary, in five pairs one only has one small button on each horn, one has one on one side only, and the remainder are entirely without any trace of them. The much older horns figured by Swinhoe have two small knobs on one side and one on the other.

Of course throughout the series this development of knobs and snags is subject to the greatest variation, and wide departures from the normal must be expected in individual heads, but the above characters, based on the whole Museum Collection, give a general idea of the antlers found in the different forms.

P. S.—Since the above was written, the National Museum has received as a donation from Mrs. Manby a first and liberal selection of a very fine series of sporting trophies collected in Burma by her late husband Mr. C. W. A. Bruce, the author of several notes on Burmese shooting in Lydekker's "Great and Small Game of India, 1900."

Included in this valuable present are some skulls and horns of

the Thamin (*Rucervus thamin*) from the Pegu Plains, and also two of the same genus from the Ruby Mines District.

These two latter, however, coming from quite a distinct area, appear to me to represent a special subspecies of the Thamin, which I propose to name in honour of the sportsman by whom the specimens were shot.

RUCERVUS THAMIN BRUCEI, subsp. n.

External characters, including foot structure, unknown.

Skull as in *R. thamin*, except that in both specimens the ridge which bounds on the upper side the lachrymal pit is comparatively little developed, its edge rounded, as compared with the strong and sharp edged ridge found in other members of the group.

Horns with much roughened surface. Brow-tine and beam not, as in all the other Thamins, in the same, or nearly the same, continuous line, but the former bent up at an angle more approaching what is found in the Swamp deer (*R. duvauceli*). Viewed from the side the ordinary Thamins have the brow-tine at about 170° - 175° with the beam, that is, nearly straight, while in *R. t. brucei* it is slanted upwards at about 130° - 140° . The same slanting up produces an angle of about 65° with the occipito-premaxillary line, as compared with about 40° - 45° in others members of the genus.

Viewed from above the two beams are directed more backwards, comparatively little divergent from each other, the middle third of one beam forming an angle of 70° to 75° with the middle third of the other, therefore decidedly less than a right angle. In *R. eldi* and *thamin*, on the other hand, the two beams diverge widely outwards from each other, the middle third of one forming considerably more than a right angle (110° - 120°) with the middle third of the other. This curvature is quite uniform in all the available adult specimens of *R. eldi* and *thamin*.

The tips of the antlers tend a little towards the broadening found in *R. platyceros*, but less developed than in that animal. The extreme tip consist in each case of two small subequal tines.

Supplementary tines at the junction of beam and brow-tine of moderate development, the type having one of 5 inches on one side and two small ones on the other; the second specimen has two small ones on each side.

Dimensions of the type :—

Skull, greatest length 345 mm.; condylo-basal length 320; zygomatic breadth 129; upper tooth-row 82.

Horns, length round curve from base 772 (30.4 in.). Circumference of base 153 (6 in.) length of brow-tine 412 (16.3 in.). The longer horn of the second specimen is 830 mm. in length.

Hab.—Ruby Mines District, Upper Burma. Type from Thim-baung-gwin Plain.

Type.—Old male skull and horns. B. M. No. 17.7.8.17. Shot by the late C. W. A. Bruce, Esq. Presented by Mrs. Manby.

The fact that the district from which these two skulls come is a considerable distance from the type locality of any described form, and that they are quite like each other, the different curvature of their main beams, the bent up brow-tines, unlike those so characteristic of the present group, and the lesser development of the lacrymal ridges, taken together, appear to justify the distinction of the Ruby Mines Thamin as a special subspecies. This I have much pleasure in dedicating to the fine sportsman who discovered it, Mr. C. W. A. Bruce, to whose widow the National Museum is indebted for the specimens.

A SELECTION OF LECTOTYPES OF INDIAN MAMMALS, FROM THE CO-TYPES DESCRIBED
BY HODGSON, GRAY, ELLIOT AND OTHERS.

BY OLDFIELD THOMAS.

Nothing has so much contributed to the difficulty in working out Indian Mammals, and the confusion that has reigned in their arrangement, as the vagueness with which the identification of the typical specimens of the early Indian describers has been dealt with, and there could certainly be no greater lesson as to the vital advantage of an original selection of types than a study of the history of Indian Mammalogy for the last 80 years, with the confusion and innumerable errors which non-selection has given rise to.

Such an original selection was not of course practised by, or known to early writers, and even Blanford, so well balanced and sensible in other things, was at first inclined to be against selection, and it was only as he gradually absorbed the lesson referred to, that he was induced towards the end of his life to select types of the species he described.

The primary difficulty in the case of Indian Mammals was an outcome of the wonderful work done in Nepal by Brian H. Hodgson, who described and figured in various journals both in India and England the many mammals which he discovered. Writing in Nepal, away from books, collections and Museums, he not unnaturally made many mistakes, and indeed it has been sarcastically said that "every animal in India has two names, one its proper name, and the other which Hodgson gave it," but in spite of all, he was the real pioneer of Indian Mammalogy, and the maker and donor of the finest collection ever made in that country until the inception of the Bombay Natural History Society's Mammal Survey.

Now Hodgson described mammals in the country as he got to know them, such knowledge coming from living specimens he saw or kept alive, and the collection that he gradually built up. No particular individual was ever selected as a type, and as more and more later specimens were added to the collection, great difficulty was found in obtaining any exact definite idea of the animals to which his name should technically be attached.

Owing moreover to the fact that he sent other specimens to Calcutta, to the Museum of the Zoological Society and the East India Company, and further collections to the British Museum, and that most of these gravitated into the National Museum in course of time, the series representing any species is often very large, and it has often been with great difficulty that specimens which could be called typical have been identified.

Recently however, in 1900, with the help of Messrs. *Blanford* and *Lydekker*, the supplementary and later specimens

have been eliminated, and "co-types" selected for many of Hodgson's names, such co-types being so far as practicable chosen from the collection he sent as forming a first typical set to the National Museum in 1843 and 1845.

Now however in connection with an important paper by Mr. Wroughton summarizing the progress of Indian Mammalogy since the date of Blanford's *Mammals of India*, a paper in which the types of all the described Indian Mammals will be designated, it has seemed advisable for the official Zoologist in charge of the Museum collection of Mammals to select definitely "Lectotypes" from the co-types, so as to avoid the perpetuation of the confusion that has hitherto reigned. Such a formal selection, made after comparison, with the other co-types, and examination of the original descriptions, entries in registers and other pertinent notes, published and unpublished, is a proceeding which gives these lectotypes the status of full types (holotypes) and is not liable to later reversal unless definitely proved to be erroneous. The whole subject will therefore be very materially simplified.

Although the Hodgson types are the most important, owing both to their number and the diverse methods in which his species were published, yet it has been thought advisable to treat all the other Indian Mammals in the same way, including those of Elliot, Gray, Horsfield, Blanford and other writers.

The following list therefore designates a lectotype for every Indian species which has not already had a single type nominated for it.

The designation is simply by the Museum register number in each case, and no detailed account of locality, or specification of other co-types, is now thought necessary, as these details, if wanted, are obtainable from other sources. In fact most of them will be found in Mr. Wroughton's forthcoming paper.

Since however when one of the several co-types is selected as a lectotype, the others lose their primary typical status, I have thought it advisable so to label the latter that later workers shall not be led astray by making comparisons with specimens marked as "co-types" without further indication. These specimens being now placed, in relation to their respective lectotypes, exactly in the position that paratypes are in relation to types, when originally selected as such, I have labelled them as "lectoparatypes" my selection of them as paratypes corresponding to the selection of their preferred brothers as types, that is lectotypes.

With regard to the very difficult question as to what generic names the species should be placed under in such a list as the present, I have cut the knot by assigning every one to the genus to which it would now be referred, irrespective of that under which it was first described.

With the help of Blanford's Mammals, and Wroughton's forthcoming list, the proper identification of every name should be quite without difficulty, while the complexity resulting from putting the original names, and thus perhaps using several different names in a single genus, is avoided.

The same difficulty is treated in the opposite way in Lyon and Osgood's Catalogue of types in the United States National Museum, 1909, but that is so large and important a work as to carry its own explanations with it.

It should be understood that the publication of the present list is only in preparation for the more complete paper by Mr. Wroughton, who has thought it better that the selection of lectotypes should be done by the person officially responsible for their custody.

<i>Pithecius schistaceus</i> , Hodgs.	Skin and skull	♂	43.1.12.1.
<i>Loris lydekkerianus</i> , Cabr.	Skin and skull		3.2.19.1.
<i>Pteropus leucocephalus</i> , Hodgs.	Skin and skull	♂	45.1.8.273.
<i>Cynopterus marginatus ceylonensis</i> , Gray.	In alcohol.	♂	58.10.19.12.
<i>Cynopterus m. ellioti</i> , Gray.	Skin and skull	♂	40.k.
<i>Rhinolophus tragatus</i> , Hodgs	In al.	♂	43.1.12.135.
<i>Hipposideros lankadiva</i> , Kel.	Skin and skull	♂	7.1.1.311.
" <i>armiger</i> , Hodgs.	In al.	♂	43.1.12.132.
<i>Scotophilus heathi</i> , Hodgs.	Skin and skull	♂	7.1.1.446.
<i>Kerivoula picta</i> , Pall.*	In al.	♂	67.4.12.342.
<i>Erinaceus megalotis</i> , Bly.	Skull only		79.11.21.515.
<i>Soriculus candatus</i> , Horsf.	Skin and skull		79.11.21.479.
<i>Felis erythrotus</i> , Hodgs.	Skin and skull		43.1.12.6.
<i>Viverra melanura</i> , Hodgs.	Skin and skull	♂	43.1.12.25.
<i>Prionodon pardicolor</i> , Hodgs.	Skin	♀	43.1.12.10.
" <i>maculosus</i> , Blanf.	Skin and skull	♂	85.8.1.28.
<i>Mungos urva</i> , Hodgs. (and <i>carnivorus</i> , Hodgs.).	Skin and skull†	♂	43.1.12.33.
" <i>jerdoni</i> , Gray.	Skin and skull	♂	46.11.9.5.
" <i>nyula</i> , Hodgs.	Skin and skull	♀	43.1.12.18.
" <i>auro-punctatus</i> , Hodgs.	Skin and skull	♂	43.1.12.20.
<i>Vulpes ferrilatus</i> , Hodgs.	Skin only		45.1.8.213.
<i>Martes toufensis</i> , Hodgs.	Skin only		45.1.8.262.
<i>Mustela temmin</i> , Hodgs.	Skin and skull	♂	58.6.24.115.
" <i>subhemachalana</i> , Hodgs.	Skin		43.1.12.12.
<i>Asiurus ochraceus</i> , Hodgs.	Skin and skull		43.1.12.35.

* cf. P. Z. S. 1882, p. 816.

† Skull separately registered: 45.1.8.54; 1445.

<i>Lutra macrodus</i> , Gray.	Skin and skull	♂	46.11.9.11.
<i>Eupetaurus cinereus</i> , Thos.	Skin only		88.9.28.1.
<i>Petaurista philippensis</i> , Elliot.	Skin and skull	♂	115.d.
„ <i>griseiventer</i> , Gray.	Skin and skull	♂	198.a.
<i>Pteromys alboniger</i> , Hodgs.	Skin and skull	♂	43.1.12.49.
<i>Ratufa macruroides</i> , Hodgs.	Skin and skull		43.1.12.76.
„ <i>elphinstonei</i> , Sykes.	Skin and skull	♂	79.11.21.579.
<i>Tomeutes lokroides</i> , Hodgs.	Skin and skull	♀	43.1.12.58.
„ <i>similis</i> , Gray.	Skin and skull	♂	43.1.12.54.
„ <i>blythi</i> , Tytl.	Skin only	♂	79.11.21.361.
<i>Dremomys lokriah</i> , Hodgs.	Skin and skull	♂	43.1.12.55.
<i>Tamias maclellandi</i> , Horsf.	Skin and skull	♂	79.11.21.372.
<i>Marmota himachalana</i> , Hodgs.	Skin and skull (young)		45.1.8.237.
<i>Marmota dichrous</i> , And.	Skin and skull		76.2.12.3.
<i>Tatera hardwickei</i> , Gray.	Skin and skull	♂	11.e.
<i>Meriones hurrianæ</i> , Jerd.	Skin only		67.2.4.1.
<i>Bandicota nemorivaga</i> , Hodgs.	Skin and skull	♂	43.1.12.67.
<i>Gunomys koh</i> , Gray, and <i>providens</i> , Ell.	Skin and skull	♀	30.c.
<i>Rattus fulvescens</i> , Gray.	Skin and skull	♂	45.1.8.376.
<i>Millardia mettada</i> , Gray.	Skin and skull	♂	34.a.
<i>Golunda mettada</i> , Gray.			
<i>Mus mettada</i> and <i>M. lanuginosus</i> , Ell.			
<i>Leggadilla samicola</i> , Ell.	Skin and skull	♂	32.d.
<i>Mus cervicolor</i> , Hodgs.	Skin and skull	♂	45.1.8.383.
„ <i>urbanus</i> , Hodgs.	In al.	♂	45.1.8.398.
„ <i>bactrianus</i> , Blyth.	Skin and skull	♀	56.2.29.4.
„ <i>booduga</i> , Gray.	Skin only		37.a.
<i>Golunda ellioti</i> , Gray.	Skin and skull		38.a.
„ <i>watsoni</i> , Blauf.	In al. and skull	♀	91.11.1.14.
<i>Microtus wynnæi</i> , Blauf.	Skin and skull	♂	3.3.9.18.
„ <i>blanfordi</i> , Scully.	Skin and skull	♂	3.3.9.17.
<i>Alactaga indica</i> , Gray.	Skin and skull		44.9.15.4.
<i>Acanthion hodgsoni</i> , Gray.	Skin and skull (young)		47.7.22.9.
„ <i>alophus</i> , Hodgs.	Skin and skull		53.8.16.11.
<i>Lepus macrotus</i> , Hodgs.	Skin and skull	♀	43.1.12.39.
„ <i>dayanus</i> , Blauf.	Skin and skull		90.4.9.3.
<i>Ochotona nepalensis</i> , Hodgs.	Skin and skull		43.1.12.63.
„ <i>rufescens</i> , Gray.	Skin and skull		44.9.15.9.
„ <i>curzonæ</i> , Hodgs.	Skin and skull		58.6.24.99.
„ <i>ladacensis</i> , Günth.	Skin and skull		75.3.30.2.
„ <i>macrotis</i> , Günth.	Skin and skull		75.3.30.3.

<i>Bubalus bubalis</i>	<i>fulvus</i> , Skull and horns	♂ .	91.8.7.215.
Blanf.			
<i>Capra falconeri</i>	<i>cashmiri-</i> Skull and horns	♂ .	12.10.31.54.
	<i>ensis</i> , Lyd.		
„ <i>jerdoni</i> , Hume.	Skull and horns	♂ .	12.10.31.52.
<i>Budorcas taxicolor</i> , Hodgs.	Skin and skull	♂ .	79.11.21.662.
<i>Oapricornis thar</i> , Hodgs.	Skin and skull	♂ .	43.1.12.89.
<i>Gazella bennettii</i> , Sykes.	Skin and skull	♂ .	42.8.6.9.
<i>Muntiacus ratwa</i> , Hodgs.	Skin and skull	♂ .	43.1.12.123.
<i>Manis aurita</i> , Hodgs.	Skin		43.1.12.85.

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